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# ON COMPOSITION OF NON-ALKALI AND HIGH MANGANOUS OXIDE GLASS

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## Introduction

As alkali-containing glass is susceptible to weathering caused by atmospheric moisture which lowers its electric insulation, manufacturers of electric insulating materials usually employ low alkali glass, which contains boric oxide in substitution for alkali, viz. borosilicate glass. In view of the fact that Japan lacks boron resources, composition of non-boron and non-alkali glass which contains no boron and yet no alkali at all was studied, aiming to manufacture glass fiber insulators and other electric insulating materials with such glass.

In the field of non-alkali glass study, there is a report on a research conducted by Kalsing and Thomas[1] on hard glass for bulbs, which was composed of 4 constituents of $SiO_2$-$Al_2O_3$-CaO-MgO based upon the low melting composition at eutectic point of ternary system, anorthite ($CaO \cdot Al_2O_3 \cdot 2SiO_2$)-forsterite ($2MgO \cdot SiO$)-quartz ($SiO_2$)[2]. By introducing MnO as the fifth constitutent, the author planned to obtain non-alkali glass with a wider composition range, which more easily melts and furnishes better workability.

Non-alkali glass obtained in this research has a special feature in that it contains such a large amount of manganous oxide as has not yet been found in the literature, and consequently it has excellent electric properties.[3] Glass of such composition can be widely utilized for industrial production of electric and chemical wares in which coloration is not objectionable. Especially during war time, this non-alkali glass was used for glass fiber products.

## Experimental Procedure

Reasons why MnO was especially chosen as the fifth oxide component besides the 4 constituents of $SiO_2$-$Al_2O_3$-CaO-MgO were: (1) that $Mn^{++}$ with its ion radius most close to that of $Na^+$ was anticipated to have structural stability such as found in soda-containing glass, (2) that MnO is a cheap material, which plentifully occurs as rhodonite in most manganese deposits in Japan, and (3) that its behavior as a flux can be applied for lowering melting temperature of glass batch.

For a procedure to derive required glass composition, three kinds of silicate containing proper combinations of the said five oxide constituents were selected, and a melting diagram of ternary system composed of such silicates was experimentally obtained. This diagram was examined to see whether glass with low melting temperature and difficult to devitrify was available or not. The silicate components used were saturated with silica and had lowest possible melting point. As such mineral components, anorthite ($CaO \cdot Al_2O_3 \cdot 2SiO_2$), diopside ($CaO \cdot MgO \cdot 2SiO_2$) and rhodonite ($MnO \cdot SiO_2$) were adopted. Theoretical composition of each silicate component is shown in the tables on Fig. 1. Of these three mineral components, all except rhodonite had been synthesized by electro-fusion method. Chemical analysis of each mineral component resulted as shown in Table I. Mixed impurities were allowed from a viewpoint of industrial raw materials.

TABLE I

| Abbreviation | An | Di | Rh |
|---|---|---|---|
| Mineral component | Anorthite (synthesized) | Diopside (synthesized) | Rhodonite (natural) |
| $SiO_2$ ..... | 41.67% | 52.71% | 49.20% |
| $Al_2O_3$ ..... | 36.20 | 1.37 | 4.29 |
| $Fe_2O_3$ ..... | 0.74 | 0.28 | 1.06 |
| CaO ..... | 20.10 | 28.41 | 5.44 |
| MgO ..... | 1.33 | 17.52 | 5.68 |
| MnO ..... | — | — | 34.35 |
| Total ... | 100.04 | 100.29 | 100.02 |

Melting temperature of each mixture was measured by ordinary quenching method, in which about 20 grams of each sample put in a platinum container was kept at sev-

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eral constant temperatures for 30 minutes and, after that, the temperature at which the quenched sample became all glass under microscope was determined to be its melting point.

Ternary melting diagram, which was constructed from results of the above measurement, referring to data of binary system An-Di already published by Bowen,[4] is shown in Fig. 1. For the reasons that the components used were not very pure compounds and that they might have not been given enough length of time to reach a perfect equilibrium, the diagram may not be regarded as a perfect equilibrium diagram, but it sufficiently serves the purpose of this research.

Melting point of natural rhodonite used in this experiment was considerably higher than the value, which Voos[5] gave as pure $MnO \cdot SiO_2$. The reason is considered to be because of a somewhat large amount of $(Ca,Mg)O \cdot SiO_2$ contained as a solid solution and also accompaniment of excess quartz.

The melting diagram obtained belongs to a comparatively simple ternary eutectic type, and its noteworthy feature is that the An- and Rh-field presents steep melting surface, while the Di-field reveals a very gentle one, so that the boundary curve between Di-An fields has a mild slope, and therefore composition difference in mixtures does not cause melting temperature to rise so abruptly from the eutectic point.

As the Di-An eutectic boundary lies along An 30%, mixtures at four points of A, B, C and D on An 30% line were examined, and they all were recognized to have low melting temperature (1220 ~ 1280°C.) and to be likely to form stable glass. Chemical analysis of composition and measurement of physical properties of such glasses resulted as shown in Table II.

TABLE II

| | | A | B | C | D |
|---|---|---|---|---|---|
| Mixing ratio of components | An | 30 % | 30 % | 30 % | 30 % |
| | Di | 50 | 40 | 30 | 20 |
| | Rh | 20 | 30 | 40 | 50 |
| Chemical composition | $SiO_2$ | 49.36 % | 49.35 % | 49.32 % | 49.55 % |
| | $Al_2O_3$ | 12.13 | 12.30 | 12.45 | 12.60 |
| | $Fe_2O_3$ | 0.73 | 0.89 | 1.04 | 1.20 |
| | MnO | 7.28 | 10.93 | 14.56 | 18.20 |
| | CaO | 21.07 | 18.65 | 16.23 | 13.81 |
| | MgO | 9.55 | 8.00 | 6.44 | 4.89 |
| Softening temperature | | 770°C. | 730°C. | 725°C. | 715°C. |
| Devitrification temperature | | 910°C. | 900°C. | 900°C. | 890°C. |
| Flowing temperature | | 1240°C. | 1220°C. | 1175°C. | 1140°C. |
| Annealing temperature | | 620°C. | 600°C. | 590°C. | 560°C. |
| Expansion coefficient (20~600°C) | | $5.18 \times 10^{-6}$ | $5.42 \times 10^{-6}$ | $4.58 \times 10^{-6}$ | $4.81 \times 10^{-6}$ |
| Specific Gravity | | 2.89 | 2.90 | 2.95 | 2.96 |
| Refractive Index ($n_D$) | | 1.610 | 1.615 | 1.611 | 1.619 |

For softening temperature in the foregoing Table II, maximum point of thermal expansion curve was taken, and flowing temperature was determined by the temperature at which a glass piece placed on a platinum plate started to flow while heated up in an electric furnace. As $SiO_2$ and $Al_2O_3$ contents are practically constant, glass composition varies according to mixing ratios of Di and Rh, and reveals such a relation as (CaO + MgO) and MnO are replaced with each other in the composition. Consequently physical properties of each glass are seen to regularly change according to Mn/CaO+MgO ratios.

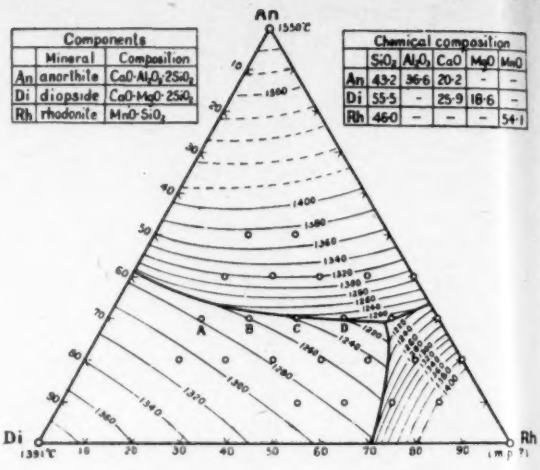


**Fig. 1. Melting diagram of ternary system, Anorthite ($CaO \cdot Al_2O_3 \cdot 2SiO_2$) — Diopside ($MgO \cdot CaO \cdot 2SiO_2$) — Rhodonite ($MnO \cdot SiO_2$)**

From such composition range, glass composition with suitable properties can be chosen, taking into consideration the purpose for use and workability.

### Composition for Fiber Glass

Initial aim of this study on non-alkali glass containing manganous oxide was to manufacture glass fiber. Generally, glass for fiber was using non-alkali borosilicate. In order to obtain a composition with properties favorable to the spinning condition of such glass, excess silica was added to base glass (B) by 5, 10, 15 and 20% and adjustment of flowing temperature and viscosity of the glass was experimented, with a result that a composition (B-10) with 10% $SiO_2$ excess addition to B-glass was considered most proper for spinning. Standard composition of this glass was determined to be $SiO_2$ 55%, $Al_2O_3$ 11%, CaO 17%, MgO 7% and MnO 10%.

For raw materials for industrial melting of non-alkali and high manganous oxide glass, batches were prepared by mixing dolomite, calcite, kaolin, rhodonite and silica sand, all of which had been finely pulverized, and the batches were melted in a small recuperative tank furnace. When the melting condition was satisfactory, obtained glass presented a green color and almost no bubbles were found, but in case of adverse melting conditions, the glass color became brownish. Consequently, glass quality, which relies upon melting condition, could be judged by its color, and more accurately by measuring refractive index of the glass pieces with a total refractometer.

Non-alkali and manganous oxide glass thus obtained and borosilicate glass hitherto used for glass fiber manufacturing were submitted to measurement of their properties under the same condition, comparative results of which are shown in Table III. Glass fiber spun from this glass presents a pale brown color, which, however, constitutes no objection for industrial purposes.

### Properties of This Non-alkali Glass

*A. Electrical properties.*

(1) Surface insulating resistance. For sample, glass fiber was used which had been washed in distilled water for 30 minutes and dried up in thermostat at 100°C. for one hour. The fiber with 15cm length was put in a

TABLE III

| | Non-alkali and Manganous oxide glass (B-10) | Non-alkali, borosilicate glass |
|---|---|---|
| Chemical composition | | |
| $SiO_2$ ..... | 54.41% | 52.75% |
| $Al_2O_3$ ..... | 11.07 | 13.48 |
| $Fe_2O_3$ ..... | 0.80 | 0.13 |
| CaO ..... | 16.78 | 15.44 |
| MgO ..... | 7.21 | 3.68 |
| $B_2O_3$ ..... | — | 14.51 |
| MnO ..... | 9.83 | — |
| Total ..... | 100.10 | 99.99 |
| Softening temperature ..... | 735°C. | 725°C. |
| Devitrification temperature. | 920°C. | 940°C. |
| Flowing temperature ..... | 1150°C. | 1050°C. |
| Expansion coefficient ..... | $5.98 \times 10^{-6}$ | $4.60 \times 10^{-6}$ |
| Specific gravity ..... | 2.89 | 2.52 |
| Refractive index ($n_D$) ..... | 1.598 | 1.549 |

desiccator at 30°C. and 90% humidity, and after left for specified length of time, its insulating resistance was measured by mercury electrodes, with a result as shown in Table IV.

TABLE IV

| | Surface insulating resistance (Ω/10cm) | |
|---|---|---|
| | After 48 hrs. | After 72 hrs. |
| No. 1 ..... | $3.58 \times 10^{12}$ | $2.94 \times 10^{12}$ |
| No. 2 ..... | $5.45 \times 10^{12}$ | $4.91 \times 10^{12}$ |
| No. 3 ..... | $4.26 \times 10^{12}$ | $3.87 \times 10^{12}$ |

(2) Surface proper resistance. A plate of non-alkali glass was used as sample and humidity characteristics in relation to proper resistance were measured. Experimental condition was that the plate was put in thermostat kept at 30°C., and after specified hours, its surface proper resistance was measured for different humidities. The result is shown in Table V.

TABLE V

| Humidity | Surface proper resistance (Ω) | | | |
|---|---|---|---|---|
| | 1 hr. | 5 hr. | 24 hr. | 48 hr. |
| 30% | $1.04 \times 10^{13}$ | $1.36 \times 10^{14}$ | ∞ | ∞ |
| 60% | —— | $2.84 \times 10^{12}$ | $3.50 \times 10^{12}$ | $3.60 \times 10^{12}$ |
| 90% | $7.33 \times 10^{10}$ | $4.03 \times 10^{10}$ | $5.07 \times 10^{10}$ | $9.26 \times 10^{10}$ |

(3) Dielectric characteristics. Using a sample in a form placed between electrodes of 5cm diameter, dielectric characteristics were measured at room temperature and atmospheric pressure by reactance variation method. The result was shown in Table VI.

TABLE VI

| | Non alkali glass | Borosilicate glass |
|---|---|---|
| Dielectric constant ($\epsilon$) ..... | 7.9 | 7.0 |
| Power factor ($10^4 \tan \delta$) ..... | 12 | 20 |
| Frequency $f$(Mc) ..... | 8 | 12 |

Dielectric constant of non-alkali glass obtained in this research is somewhat higher than that of borosilicate glass, while tan $\delta$ is a little lower, so that in dielectric characteristics it excels borosilicate glass hitherto used for making high frequency insulator.

(*Continued on page* 376)

Table VII

| | Testing condition: Treatment | Time | Non-alkali glass | Borosilicate glass |
|---|---|---|---|---|
| Thermal durability | After kept at 300°C. in electric furnace for specified hours, lowering rate of tensile strength was measured. | 0.5 hr. | 99.7% | 97.3% |
| | | 1.0 | 91.0 | 91.8 |
| | | 2.0 | 89.5 | 85.0 |
| | | 3.0 | 84.8 | 84.5 |
| Weathering test | After kept at 140°C. in saturated vapor in autoclave for specified hours, lowering rate of tensile strength was measured. | 0.5 hr. | 101.3% | 104.0% |
| | | 1.0 | 97.0 | 96.0 |
| | | 2.0 | 88.3 | 94.1 |
| | | 3.0 | 86.0 | 90.1 |
| Acid resistance | After boiled in 1-N hydrochloric acid for specified time, weight loss was measured. | 2.0 hr. | 3.91% | 43.15% |
| | After boiled in sulphuric acid of sp. gr. 1.205 for specified time, weight loss was measured. | 2.0 hr. | 3.60% | Nearly all dissolved |
| Alkali resistance | After boiled in 1-N caustic soda solution for specified time, weight loss was measured. | 2.0 hr. | 3.25% | |

# FIRE POLISHING OF GLASSWARE

**By ROBERT C. LeMAY**

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Seldom has an industrial process been so widely used and yet so little publicized as has the fire polishing of glass. Although quite essential in producing much of the glassware in common use, this process has apparently received no mention in trade literature of recent years. Perhaps directly resulting from meager communication between glass plants employing it, a situation has now revealed itself to which open discussion may contribute substantially.

The purposes of fire polishing are well-known to glass men. To remove cutting edges and unsightly mold marks, to smooth grinding marks, to seal incipient cracks and fissures, and to increase surface lustre, fire polishing is employed. The latter objective involves the fusion of broad surface areas, and is generally known as glazing. Fuel gas and air are used for the purpose whenever available. If employed successfully, ware surfaces are melted and flowed while ware bodies are held sufficiently rigid to maintain shape. This is accomplished by passing hot ware through and in actual contact with gas flames.

As alternate means of securing some or most of the desired results, some plants "polish" by acid immersion or by brushing with abrasive materials. Only fire polishing, however, will strengthen ware by sealing tiny cracks and fissures. Although least costly of the three, fire polishing as usually practiced is probably the most difficult method to control.

By performing the fire polishing operation while ware is at temperatures well above the strain point (where additional thermal strain cannot occur) and just preceding the anneal, it is possible to avoid breakage which could be expected at lower temperatures. In the interest of economy, therefore, fire polishing is performed whenever possible directly between hot forming and annealing operations—and as soon as possible after leaving the mold.

When additional operations such as cutting or etching are performed, it is necessary to reheat the ware as part of the fire polishing process. As is the case where this operation immediately follows initial forming, ware is transferred directly from fire polishing to the annealing lehr.

## Present Situation

Most heavily used in bottle and tableware plants, fire polishing burners, and to a lesser extent machines, are found in a wide variety of designs and operating with all degrees of satisfaction. Recent visits to glass plants in several industrial areas found operators in general seeking better equipment for the purpose. Acid shortages, increased production speeds and higher product quality standards are major reasons for this demand. Where excessive gas use has overheated plant working areas, desire for improved working conditions has also been expressed.

In search for better methods, much new equipment has been installed, both purchased and "home-made." A fairly high proportion of this has been in turn discarded for something which later promised better results. In general, during this evolution, handling equipment had been worked out reasonably well. The greatest demand for improvement involves combustion equipment. Responding to this demand, recent studies have been carried out in both laboratory and glass plant, and have resulted in what might be termed a *new approach*. This has been made possible by clarifying basic requirements of the fire polishing operation itself.

## The New Approach

The new approach to fire polishing embodies four sig-

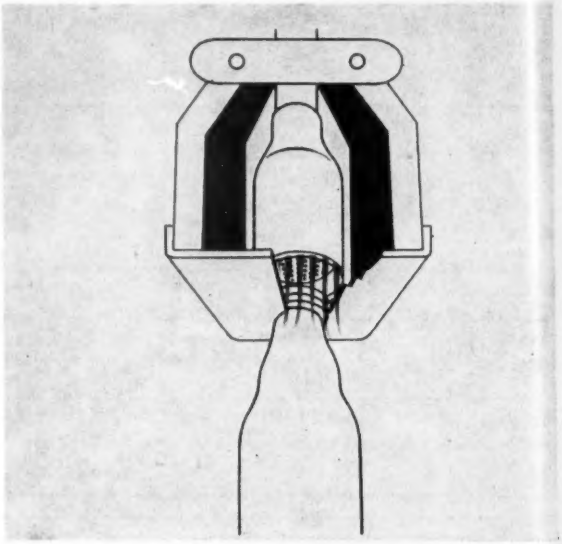

**Fig. 1. Fire finishing within the arm transferring bottle from forming machine.**

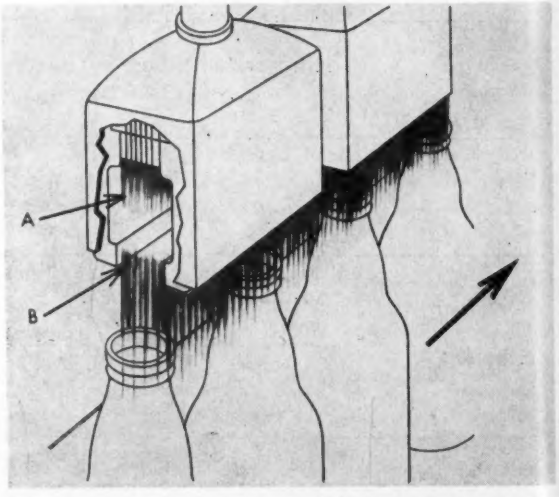


**Fig. 2. Bottle mouths being "polished" during transfer on single-line conveyor from former to lehr.**

Presented before the American Gas Association, Industrial and Commercial Gas Section.

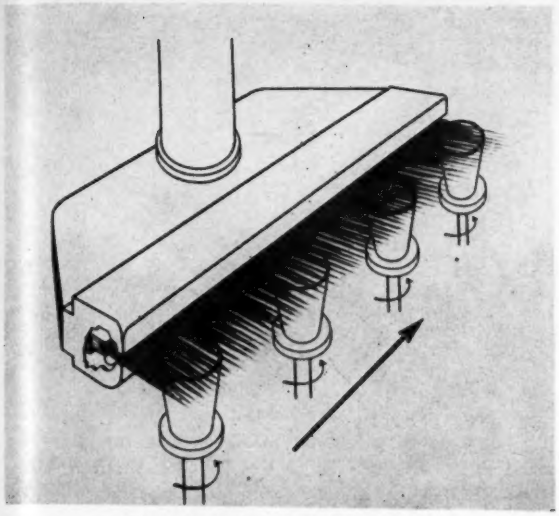

**Fig. 3. Fusion of table tumbler lips during rotary-horizontal travel before special flame-retaining ribbon burners.**

nificant features. The first requires *selection of burner equipment which distinguishes between* heating of ware bodies and fusion of edges or surfaces. Recent studies* of the use of radiant energy in other glass heating operations have clearly shown that glasses which admit radiant energy—and this includes most commonly used formulas—are by this means heated both internally and externally at the same time.

In fire polishing operations, excessive proportions of radiant heat can and often do soften ware bodies and cause disastrous loss of shape before surfaces are adequately fused. Both laboratory investigation and operating experience here combine to indicate burner types for fire polishing which produce *surface heating primarily*, with a minimum of radiant energy. Radiant heat from incandescent surfaces or luminous flames should be confined in this operation to preheating before fire polishing or to annealing afterward. For preheating and annealing, however, significant advantages of controlled radiant heating have been clearly demonstrated.*

Sharp "blue" flames emit relatively little radiant energy and do a satisfactory fire polishing job when properly handled. To illustrate this, a New York State bottle plant recently experienced difficulty in finishing bottle mouths. Subsequent analysis showed that excessive radiant heat in the transfer arm burner was softening bottle necks so that acceptable tolerances were exceeded. Replacement with a suitable multiport burner of the "blue" flame type satisfactorily corrected the condition.

The second feature requires that *burners permit separate and independent control over flame retention and flame quality*. When used with slower burning natural gas, much of the older burner equipment has required a compromise gas-air ratio adjustment between that which produces the best ware and that which is necessary to keep the flame on the burner. With faster manufactured or enriched gases, compromise adjustment is often required to prevent flashback into the mixture line. Obviously, compromise flame settings can reduce the speed and effectiveness of any heating operation.

The third feature involves *control over flame geometry*. Burners should be selected which maintain sharp flames on the edges being fused. The exception to this is that operation intended to melt over-all surfaces for increasing lustre. Confinement of flame shape may be accomplished with standard burners, or burners may be specially designed whose flame is shaped to the ware. It will be readily understood that the third feature implies departure from the once much used wallowing flames which played indiscriminately over the ware. Flame confinement not only provides greater control over the operation, but also improves nearby working conditions and can save thousands of dollars in annual gas consumption.

The fourth feature involves constant and uniform operation. *This requires equipment capable of maintaining*

* "Radiant Heat in the Glass Industry" from THE GLASS INDUSTRY, July 1951.
"Radiant Heating in Glassworking Production and Equipment" from the *Bulletin of the American Ceramic Society*, January 15, 1950.

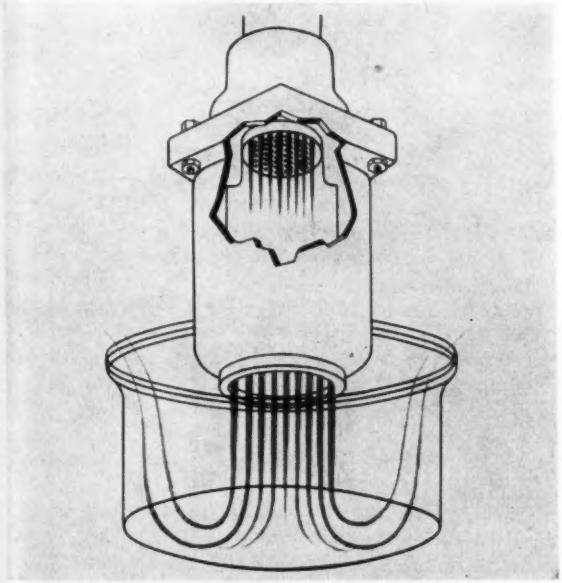

**Fig. 4. Glazing of electric meter case interior surface beneath special vertical burner.**

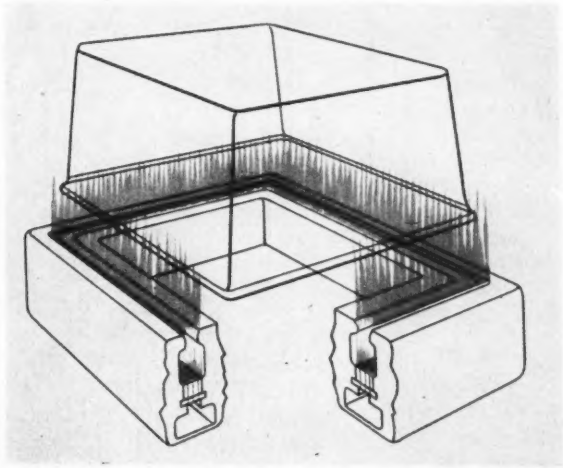

**Fig. 5. Fire polishing borosilicate glass is often performed with burners shaped to the ware.**

*constant but adjustable gas-air ratios and unvarying mixture pressures at the burners.* All fire polishing requires blast type combustion, and to be most effective, flame delivery should remain uniform for any one type of ware. This requires that combustion shall not be affected by gas and air pressure fluctuations at the point of mixing, or by change in the number of burners attached to a single gas-air proportioning device. Such uniformity is required to prevent overheating and collapse of delicate ware on automatic glazing machines. Close control of flame chemistry (air-gas ratios) is required to prevent discoloration of glass such as that which occurs when lead glasses are exposed to "reducing" flames.

### Typical Installations

Description of some of the better fire polishing operations will serve to illustrate both the nature of the process and application of the new approach. These have been selected at random from among ware types for which this operation is usually required.

*Beverage Bottles.* In many plants the outer edges of a bottle are finished by a small round burner firing down on the bottle top from its position in the transfer arm, during removal from forming machine to conveyor. Figure 1 shows schematically where this is accomplished. Burners are usually of the multiport type, slightly larger in diameter than the bottle top. Actual burner ports are molded in ceramics or formed from alloy metals for heat resistance, and flame retention is provided in some form. This heating method permits one machine to form bottles of different heights simultaneously. As increasing production rates reduce exposure time during transfer, some operators have found it necessary to enrich with oxygen or to fire polish in a separate operation elsewhere.

When all bottles from one machine are the same height, stationary lines of burners may be used to play down upon the tops from above as they pass beneath on a transfer conveyor. Figure 2 shows one of the more satisfactory burners now used for the purpose. Flame retention is adequately provided by burning the gas within chamber

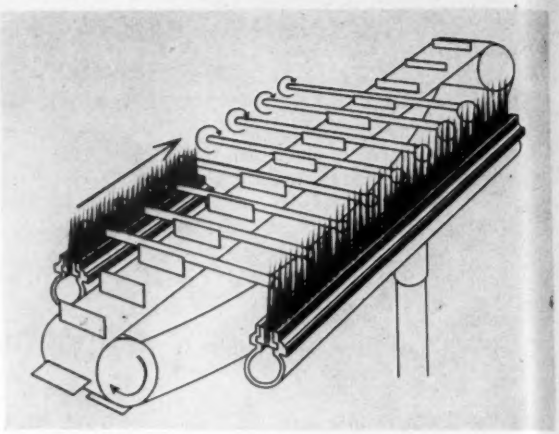

**Fig. 6. Time of flame exposure determines whether glass rod end is merely smoothed or formed into a ball.**

(a) and discharging it through mouth (b) as very hot combustion products. The number of individual burners required for the line, of course, is proportional to hourly bottle production and to time out of the mold. Also used for this application are alloy or ceramic screen blast tips or ribbon burners with suitable provision for flame retention.

It is reported that proper fire polishing of bottle mouths increases the useful life of forming molds by eliminating the excess ridge of glass resulting from mold wear.

*Table Tumblers.* Whether blown or pressed, table tumblers require fire polishing along the top edge. This is required for safety, and sometimes also to permit proper sealing if the ware is marketed initially as a food container. In one process a bead is formed along the rim while blown tumblers are being burned off the moiles. In other cases a separate fire polishing operation is required.

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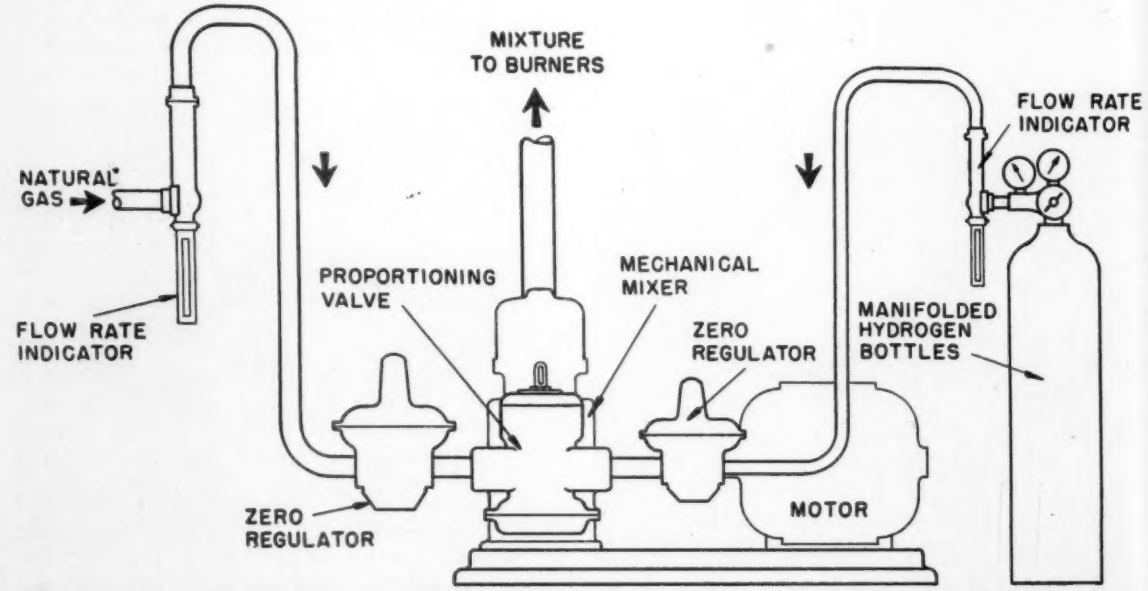


**Fig. 7. Use of a mechanical mixer for enrichment of natural gas with hydrogen.**

# COMMENTS ON "DR. E. U. CONDON COMMENTS ON— THE ANNEALING OF FLAT GLASS"

The Editor
THE GLASS INDUSTRY

Dear Sir:

It was gratifying to welcome one of the first rate scientists of all time joining us in the field concerning a unique substance which almost could be classified as the "fourth state" of matter. It was even more exciting to see a modern director of research engaged in the actual work of researches rather than that of other essentials. I am referring to "Dr. E. U. Condon Comments on—the Annealing of Flat Glass," published in the June, 1952 issue of THE GLASS INDUSTRY, in which he gave an analytical treatment to the annealing data of Boris Daragan published in the February, 1952 issue of THE GLASS INDUSTRY.

I can fully appreciate Dr. Condon's analysis after having determined periods associated with the delayed neutron emmitters from the fast neutron fissions of uranium and thorium—a determination apparently not carried in World War II time because it concerned fast neutrons. Although the "peeling off" technique usually does not yield results of high accuracy due to the intrinsic nature of the process, as pointed out by Dr. Condon, it is rather revealing to those not familiar with the process of annealing that fairly well defined periods or relaxation times, $\tau$, can be assigned to various transitions or changes that occurred.

Borrowing the concept from the radioactive decay process, the reciprocals of these relaxation times may be called the disintegration constants or preferably the rate constants, $\lambda$. It is the number of changing events per unit time associated with the particular relaxation time. Since the mechanism involved is a rate process, it seems reasonable that equations relating the rate constant to the free energy and entropy changes such as those developed by Eyring[1] may be applicable. A typical form of Eyring's equation is as follows:

$$\lambda = a\,T\,e^{-\Delta F/RT} = a\,T\,e^{\Delta S/R}\,e^{-\Delta H/RT} \qquad (1)$$

where T is the temperature in °K, $\Delta F$, $\Delta S$, $\Delta H$ are the changes of free energy, entropy and heat content for the activation of the process in consideration, R is the gas constant per Avogadro number, and a is a constant for a given process involving a certain equilibrium distance of the process and other fundamental physical constants. Since Daragan's original work also gives data with respect to temperature variations, it should be possible to evaluate a set (4 in the light of Dr. Condon's work) of $\tau$ or $\lambda$ values for each of all the temperatures. By shrewd guessing or trials, one might be able to obtain an analytical expression of the Eyring's type for each of the four relaxation processes. Consequently, the changes of free energy and entropy associated with each process may be evaluated. The change of free energy of activation should tell how easy or difficult is the particular process involved and the change of entropy would indicate relative degrees of randomness in the orientations associated with the various processes.

In the present considerations, the change of density, or the change of number of atoms or atomic grouping per unit volume, seems to be a less revealing physical quantity than the change of volume per unit number of "stochiometric" atom or atomic grouping. This is particularly true in view of the fact that the volume of a glass seems to assume an additive relationship to the first approximations with respect to the volumes occupied by or assigned to its constituent atoms or atomic groupings. This distinction concerns future development and is irrelevant to Dr. Condon's present treatment. Furthermore, the two approaches can be interconverted rather easily. Thus:

$$\Delta v = -\Delta d/d^2 \qquad (2)$$

where v and d are the specific volume and density of the glass, respectively. Dr. Condon's equation, then, becomes:

$$\Delta v = -\left[\sum_i d_i\, n_{io}\, e^{-\lambda_i t}\right] / d^2 \qquad (3)$$

where d may be considered as a constant to the first approximation. Preferably, one could begin with the change of the volume in the analytical graphical process and obtain a similar but more direct equation as follows:

$$\Delta v = \sum_i v_i\, n_{io}\, e^{-\lambda_i t} \qquad (4)$$

where $v_i$ may be defined as the change in specific (or other atomic or molecular) volume involved in the structural alterations.

Glass is complex enough a substance even when one deals with a one-component system. The present discussions refer to a flat glass of multi-components. It is only natural to urge that future studies be directed to the simplest systems. One might have a chance to associate certain relaxation times, free energies of activation and entropies of activation with certain atomic groupings of definite chemical identifications.

After the above was written, it was noted that Dr. N. W. Taylor has arrived at a place where Dr. Condon and the writer have visited just now. Although Dr. Taylor dealt with different physical properties and his equations appeared different from those of Dr. Condon, the physical insight and the analytical treatment are really identical. Besides pointing out the similarity of these works, the study of entropy changes and the emphasis on the volume changes rather than the density changes should warrant the publication of the present note to those interested.

Kuan-Han Sun
Pittsburgh 35, Pa.

(1) S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, McGraw Hill Book Co., New York. 1941.

(2) See, for example, N. W. Taylor, "Anomalous Flow in Glasses," Jour. Phys. Chem., *47*, 235-253 (1943).

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• Leon Appleman, President of the Appleman Glass Works, has announced the appointment of Rogers and Cowan, public relations firm of New York and Beverly Hills, to handle the publicity and public relations campaign for Electriglas of Bergenfield.

# CAN FOREMEN "TEACH ECONOMICS" TO EMPLOYEES?

**By FRED RUDGE***

When it comes to teaching economics to employees, the foreman is the most important member of the "faculty." He doesn't have to wear a cap and gown or polish up on lecture-room techniques. Call him "teacher" or "professor" and he'll probably spit in your eye, at least metaphorically speaking. Yet the chances are he already is imparting economic information day in and day out to his subordinates. Helping him tell more, both by giving him the required data and by encouraging workers to ask questions, is the key to success in making them understand the economic forces which influence company behavior.

Without departing from his normal relations with subordinates, the supervisor has abundant opportunity to enlarge his teaching role. For example, the people whom he directs look to him for instruction in their duties and for the "reasons why" behind directives. He strives to win their cooperation in recruiting new employees, or by reducing turnover, absenteeism and lateness. He is constantly promoting productivity, cost control and safe work habits, and probably finds it necessary from time to time to explain pay rates and incentives. Economics enters into all such things and each provides a "hook" on which to hang an economics "lesson," be it only a few sentences long.

For example, a worker's question about the incentive system opens up the whole area of costs and prices, of productivity, company security and employee job security. A drive for better quality is related to such questions as competition, free markets and the buyer's right to choose some other product—or not to purchase at all. The question of a second shift, or of a lay-off, goes back to such economic issues as supply and demand; the cost of expansion as compared with increased use of available facilities; the relation of the individual company to the economy as a whole, and so on.

This man-to-man approach is usually far more convincing than printed material or formal instruction, although these have a part in the all-over economics education project. They supplement, rather than replace, the word-of-mouth communication which experience shows is the all-important factor in efforts of this kind. To be effective, communication must be a two-way process, with those on the receiving end in a position to inquire and participate. An exchange of information is always better than a one-way stream. Foremen are uniquely situated to assume a vital communications role because they stand between middle management and the rank-and-file.

But before expecting supervisors to pitch in and start teaching, management should check up on certain things: (1) Has the right kind of material been compiled and given to the foremen for them to pass along? (2) Are the supervisors prepared to undertake the job? (3) Does the company back them up with other forms of training —direct communications from the management, employee meetings with top executives, etc.?

* A partner in the firm of Fisher, Rudge & Neblett, a management consulting service in the field of industrial, labor and community relations. Mr. Rudge is the author of "Economic Information for Employees," published this year by National Foremen's Institute, and the section on Plant Community Relations in Funk & Wagnalls' "Reading Course in Executive Techniques."

### Company Facts are Best for Program

Both foremen and their prospective "pupils" shy away from global economic trends and theories, which usually prove too general and too dull to hold interest. On the other hand, employees at all levels are usually avid for information about the economy, and on why the management follows certain policies. The most successful economic education programs are those which have concentrated from the start on examples taken from the company's own history, development and experience. Rather than being designed primarily to "sell" the private enterprise system, they are beamed at helping workers grasp the economic "facts of life" *about the company and the industry,* including why the management pursues the course it does in conducting operations.

The foreman who has such facts at his command is giving employees what they really want to hear, facts which have a bearing on their job security, their opportunities for advancement, improvement in their social status, and the like. The rank-and-file craving for such information is demonstrated whenever anything unusual happens in their plant, because they naturally ask "How come?" when things aren't running as smoothly as they should. If a schedule is changed, and short runs interrupt production, they usually want to know why. They are quick to complain if maintenance is cut in slack times. "Why let things go," they ask, "until business picks up and the plant is too busy?" They criticize the sales department if orders must be completed on short notice, or if they come too slowly. They also tend to regard essential accounting and engineering personnel as so much extra overhead. "Why are we supporting all those guys?"

Direct answers naturally must be given to such questions, but piecemeal information is not enough. There should be a backdrop of rounded information against which to view specific problems. Such perspective is provided when the economic education program gives the history of the company: how it was started; where the money came from to finance early operations; how it is presently financed; the competitive position of the company and how its products are marketed; the various factors which combine to set the prices of what the company sells; the part that profit plays in keeping the enterprise going; the functions which management performs, including the need for decision-making and management know-how making sound decisions possible.

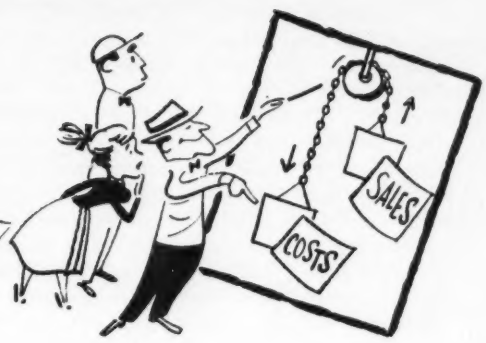
Few companies have this kind of information available at the time the decision is made to launch an economic education program. It has to be gathered from various sources, including the firm's own executives, its sales department personnel and the trade association to which it belongs. Some, but not much, can be dug from textbooks. Of course, the facts compiled should be screened for accuracy by qualified management personnel. When it *is* gathered, the initial step is to *educate the foremen* economically. The rest of the program should rest until the supervisors are ready to undertake their teaching role.

### Preparing Foremen for Economic Education

There are many reasons why special efforts must be

Foremen should have a voice in shaping the economic education program.

The man-to-man approach is more convincing than printed material.




The foreman doesn't have to wear a cap and gown to be an economics teacher.

made to give information and facts to the foremen. The average supervisor is separated from top management by several layers of executives, and this tends to insulate him from the economic understanding possessed by the highest group. In addition, attitude surveys among supervisors have often shown that foremen have not been admitted to the "inner circle" of management, even though they speak for management in their departments. In many cases, the foreman's position and importance must be enhanced to give him greater authority and status in the minds of the rank and file. Obviously, foremen must be recognized as leaders if what they say is to win acceptance from others.

Foremen should also have a voice in shaping whatever printed material and other supplementary communications are to be distributed to employees as part of the program. If the foremen are built into the program from the start, via group meetings and conferences with management, they will contribute mightily to its development. Of course, everything distributed as part of the project should be coordinated with the supervisors' own efforts.

Experts agree that the most fruitful prelude to active economic education is the "ground preparation" phase, in which three important developments take place: (1) Action to put the foremen in position to communicate. (2) Action to *inspire* the foremen to communicate—to make them want to take part in the program. (3) Action to create a desire, on the part of the employees, for information on economic questions.

With this three-way approach begins a truly effective program of economic education.

### Overcoming Foreman-resistance to "Teaching"

Nobody in his right mind expects foremen to take to economic education as the proverbial duck does to the barnyard pond. The following colloquy shows how the typical foreman reacts to the idea, and the kind of answers needed to win him over:

*Question.* You want us foremen to get more information to our people? Okay! That's fine. But I'm the wrong guy: I'm not equipped to pass around information of that sort, even if I had it, which I don't.

*Answer.* Your top management is liberal and progressive and does want to communicate with its people. The facts are being gathered and interpreted right this minute. But you are the person who can make or break the effort. Why? Because you *are the management* in the minds of people who report to you, and you have dozens of opportunities every day to tell why top management does thus and so about particular situations. You are in a position to give the "reasons why" about all kinds of things. Remember, one talk on a man-to-man basis is better than fifty pounds of the best printed matter in the world.

*Question.* What bothers me is why we should make the attempt. Employees don't care what the top brass think. All they are interested in is their pay—how much there is in the envelope at the end of the week.

*Answer.* That may apply to some, but it isn't true of everybody. Job satisfaction goes beyond being paid a proper wage. You know yourself that people aren't just satisfied to take an order and carry it out. It has to add up in their minds. The trouble is, it won't unless the people know something about the business and how it operates, and also about the basic economic principles that underlie about 90 per cent of management's decisions. You have to know the ABC's of business economics to discuss them intelligently.

*Question.* Maybe so, but how can foremen teach economics when we still haven't solved the simplest problems of explaining? I mean questions like: Who has the authority to make decisions? What are our employee policies? Why don't employees who make suggestions get thanked for them, let alone being paid for those adopted?

*Answer.* All those things are part of a good two-way communications system, and getting one going is an important part of this economics education project. Management is going to tell *you* "why" about such matters, so you can either answer such questions on the spot or else know where to turn to get the information.

*Question.* I have twice as much work as I can handle right now. On top of that, how do you expect me to do a teaching job?

*Answer.* The more you lead your people, the more cooperation you'll get, and the lighter your own work load eventually will become. Good leadership means telling why; and that includes explaining company policies

and economic reasons as well as telling a particular subordinate why you are giving him a certain order. This isn't a classroom proposition, it means just a few minutes a day talking to your people as occasions arise.

*Question.* I don't want to sound selfish, but, what's in it for me?

*Answer.* The best pay-off of all, a better chance of promotion. Learning about the business and about economic principles is the high-road to more effective leadership. The more you know about the company, the more intelligently you will be carrying out your orders. The suggestions you make will become more and more valuable, and you will become better and better equipped to take on increased management responsibilities.

*Question.* Sounds good, but, do you really expect a program like this to change employees' ideas about how good, or how lousy, our business system is and what should be done about it?

*Answer.* It isn't your job to make people's minds up for them. The objective is to give *factual evidence*, so that people can make up their own minds, and do it intelligently. Your job is to take facts you *believe in and accept*, and then pass them along to your people.

**Employees Crave Information**

Many foremen fail to realize how much employees crave information about the company, about "the way they stand," about the reasons for changes they see taking place. Attitude surveys among the rank-and-file frequently bring out complaints of being "left in the dark." How strong the urge for information is can be seen from the following typical statements made to our researchers by employees:

> "Everything around here is hush-hush. You hear things a dozen different ways before it finally becomes official."
>
> "I think meetings would help. It would give us a chance to hear what the company is doing."
>
> "Nobody seems to know what's going on. The supervisors may know, but they're always too busy getting out the work to talk about such things. Sometimes I think they won't know the answers, either."

**Training is Required**

Supervisors, as a rule, don't become good communications experts by chance. They usually need training in how to put ideas across. Equally important, they have to get "in the stream" of company information, so they will understand the policies and practices of top management. Companies sometimes find at this stage that they have no adequate body of written information: a regular program of foremen conferences provides the incentive for organizing such data and filling in the gaps. It is not unusual for a whole new series of booklets, including employee manuals, standard practice instructions, safety reminders, etc., to emerge as a by-product of the course.

The principles of sound communications cannot be learned in one easy lesson. They call for training and for practice until it becomes second nature for the foreman to remember, among other things, that:

1. *Words may be confusing.* What seems clear to the speaker may not be so to the listener.

2. *Two-way communication is vital.* The supervisor has to listen, to answer questions, to stimulate discussion, as well as "tell" the employee.

3. *Intent is often more important than words.* The supervisor needs to remember constantly that the listener may be saying to himself, "That's what he *says*, but what does he really *mean*?" Words that are contrary to the listener's experience may be clearly stated, and yet carry no weight.

4. *Trust is vital.* The foreman who has not won the respect of his people cannot expect much success in putting across an idea. He may even do more harm than good.

5. *Know your man.* It helps to know the individual's personal problems, his experience and his point of view. He may even belong to the tiny percentage in almost every group who are "ag'in everything." If so, special treatment may be in order.

6. *Stick to the facts available.* A statement of fact is usually more impressive than a statement of opinion. Therefore the supervisor should find out the real "reasons why" before attempting to persuade others.

7. *Be prepared to find out.* If the right facts are lacking in a particular case, the best course is to say "I can't answer that question." Then obtain the information and pass it along to the questioner.

**Checking up on Progress**

At intervals during the program, its progress and effectiveness should be measured, and reports made to top management. Depth attitude research among the foremen themselves is an indispensable tool. The foremen conferences can also be utilized to evaluate the project. Like a faculty meeting in the public schools, it helps to get the "teachers" together and sound out their reactions to the course and ascertain how well the "students" are absorbing knowledge.

This is part of the *foreman participation* in the program, and in the management, which spells the difference between successful economic education for employees and "just another idea from the Boss."

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**DRAKENFELD HONORS EMPLOYEES**

Thirty-five employees, with a combined total of 827 years of service, were guests of honor at a picnic held at Washington Park, Washington, Pa., by B. F. Drakenfeld & Co., Inc. The employees were introduced individually by Dr. R. R. Shively, Vice President in charge of operations. Dr. Shively himself, now completing thirty years with the company, holds the distinction of having the longest record of continuous service.

Singled out for special commendation were six men with twenty-five years or more of service.

**WYANDOTTE APPOINTMENT**

Wyandotte Chemicals Corporation has announced the appointment of H. E. Tremain as Director of a newly created department of contract research.

Mr. Tremain, formerly assistant to the Vice President of the Research-Development Division, will be in charge of all research activities under direct contract with governmental agencies. The new department will coordinate these activities.

# Inventions and Inventors

## Feeding and Forming

*Mold for Footed Ware. Fig. 1. Patent No. 2,598,524.* Filed Oct. 11, 1948. Issued May 27, 1952. Two sheets of drawings. Assigned to Anchor Hocking Glass Corporation by F. Z. Fouse.

This is a method and mold for making footed ware which is first pressed and then blown. A gob is pressed in a one-piece mold 7 having a neck ring 10 and a bottom plate 8. A shear blade 13 has an opening 11 through which the molten glass passes to form the foot. After the pressing operation, the shear blade is moved over to sever the stem. The neck ring can then lift the bowl out of the mold and the foot can be removed on the bottom plate. The two parts are then placed in a blow mold with the parts in contact or nearly so. The blowing operation causes the stem to be welded together where it was severed.

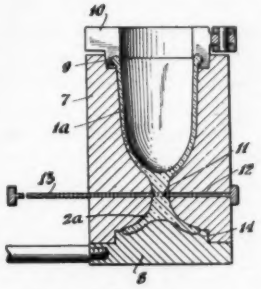


**Fig. 1. Mold for Footed Ware.**

The patent contains 12 method and apparatus claims and the references cited were 132,216, Oesterling, Oct. 15, 1872; 1,603,524, Dunbar, Oct. 19, 1926; 2,272,119, Jaeckel, Feb. 3, 1942; and 193,939, Germany, Jan. 9, 1908.

*Gob Delivery Device. Fig. 2. Patent No. 2,598,955.* Filed Aug. 5, 1946. Issued June 3, 1952. Four sheets of drawings. Samuel E. Winder, inventor; assignor of one-half to Henry C. Daubenspek.

This device is in the form of a tube having its upper end pivoted near the feeder outlet and the lower end actuated to follow the path of the mold during delivery. A water-cooled tube 77 is mounted to swing about pivots 72, the lower end being reciprocated by a cam through connections indicated at 155, 181, etc., so that it follows for a short time, while the gob is being delivered, the path of the blank mold 39. Obviously this mechanism is intended for use with a continuous forming machine.

The patent contains 28 claims and the references cited were 1,660,125, Hanford, Feb. 21, 1928; 1,761,792, Jaeger, June 3, 1930; 1,843,160, Ingle, Feb. 2, 1932; 1,976,239, Lorenz et al., Oct. 9, 1934; 2,038,519, Barnard, Apr. 28, 1936; and 2,209,018, Peiler, July 23, 1940.

## Furnaces

*Glass Melting Furnace. Fig. 3. Patent No. 2,597,585.* Filed July 1, 1949. Issued May 20, 1952. Two sheets of drawings. George E. Howard, inventor.

This is a modification of the invention shown in Howard's Patent No. 2,564,783. The figure, which is a vertical section through the furnace, shows a tank 4 of conventional form having burners 5 and a bridge wall 6 and a collecting basin 9 which supports the batch material. The batch is in a vertical stack having a series of baffles 15, 16 and 17 and burner openings 18, 19 and 20 and a corresponding set of baffles on the opposite wall. The main body of batch material in the form of briquettes, containing some large lumps of silica or fused alumina A, is fed from a hopper 31. A second hopper 32 contains batch material such as silica brick or fused or sintered alumina. This material is in larger lumps than in the other hopper.

The batch is fed by pushers 33 and 34. The flow of heat is indicated by arrows and the waste heat passes out through pipes 37 and 38. Any obstruction may be drawn off by a valve 36 in the bottom of the stack.

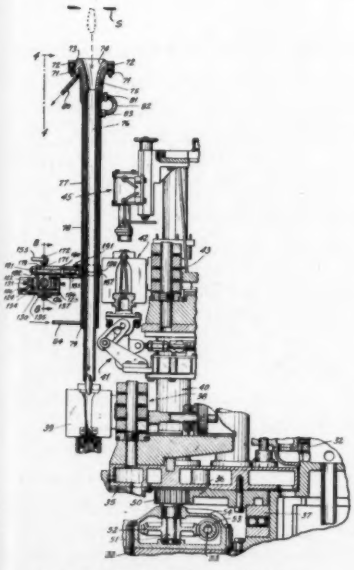

**Fig. 2. Gob Delivery Device.**

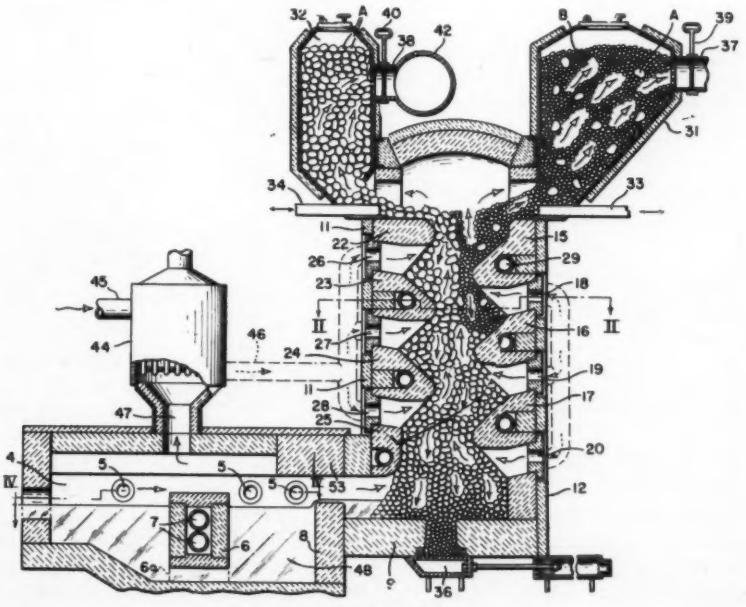


**Fig. 3. Glass Melting Furnace.**

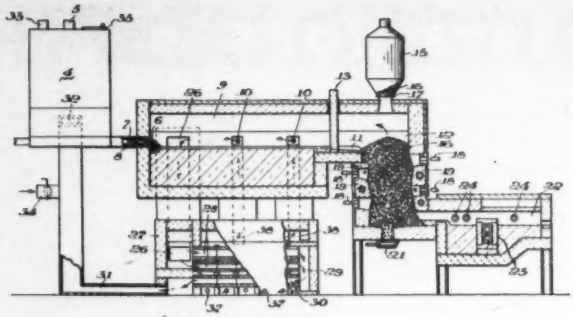

Fig. 4. Glass Melting Method.

The patent contains 23 claims on the apparatus and method and 10 references were cited.

*Glass Melting Method. Fig. 4. Patent No. 2,597,640.* Filed Oct. 17, 1950. Issued May 20, 1952. Two sheets of drawings. George E. Howard, inventor.

This invention is an improvement over Patents No. 2,564,783 and 2,597,585, the latter being noted above. The apparatus for practicing the invention includes a hopper 4 which delivers the usual batch material to the furnace 9 by a feed pipe 7. The molten glass from this furnace passes under an adjustable gate 13 to a vertical hopper. Over this hopper there is a chamber 15 which discharges refractory lumps, perhaps 2 to 4 inches in diameter, of platinum, for instance, which will not melt below 2600°F. The vertical stack and forehearth 22 appear to be more or less like that in the preceding patent.

The invention is set forth in Claim 3 as the method of melting and refining glass, which comprises melting glass batch materials, passing the molten materials in a generally downward direction through a body of loosely arranged lumps of material more highly refractory than the batch and which are heated to a sufficiently incandescent state to refine and plane the glass, and forming a pool of the refined glass.

The patent contains six claims and references cited were Re. 20,828, Powell (I), Aug. 16, 1938; 1,600,484, Owens, Sept. 21, 1926; 1,610,376, Hitner, Dec. 14, 1926; 1,877,714, Bulask, Sept. 13, 1932; 2,190,271, Powell (II), Feb. 13, 1940; 2,268,456, Forter, Jan. 6, 1942; 2,294,373, Batchell, Sept. 1, 1942; 2,508,629, Tanberg, May 23, 1950; and 486,447, Germany, Nov. 25, 1929.

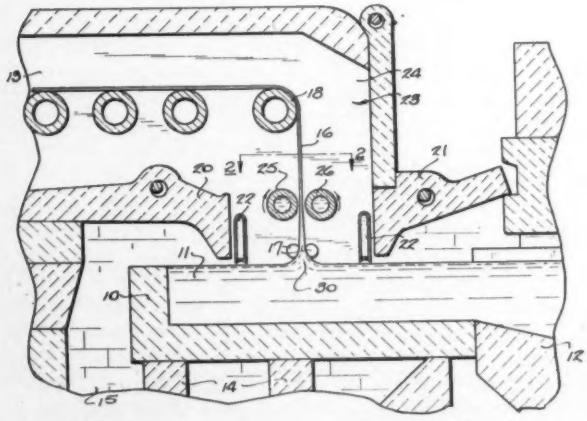

Fig. 5. Colburn Type Sheet Drawing Machine.

## Sheet and Plate Glass

*Colburn-Type Sheet Drawing Machine. Fig. 5. Patent No. 2,598,893.* Filed Aug. 20, 1945. Issued June 3, 1952. One sheet of drawings. Assigned to Libbey - Owens - Ford Glass Company by John L. Drake.

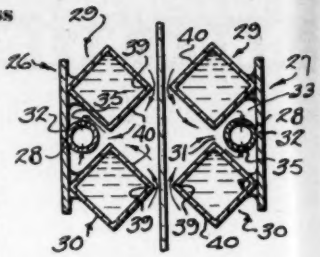

Fig. 6. Sheet Drawing Device.

In addition to the construction common to a Colburn machine, the invention includes a pair of water-cooled rolls 25 and 26 which rotate in opposite directions and are spaced from the sheet 16. The position of these rolls may be adjusted as desired. This sets up air currents in the opposite direction from the travel of the sheet.

The patent contains one claim and 10 references were cited.

*Sheet Drawing Device. Fig. 6. Patent No. 2,598,894.* Filed Sept. 14, 1945. Issued June 3, 1952. One sheet of drawings. Assigned to Libbey-Owens-Ford Glass Company by John L. Drake.

Like the preceding patent, the object of this invention is to improve the quality of the glass by improved cooling means. Lip-tile coolers are provided and special heat exchangers 26 and 27 shown in section in the figure. These comprise square water-cooled casings 29 and 30 mounted on plates 32. Between each pair of casings there is a pipe 28 connected to a source of vacuum. Each of

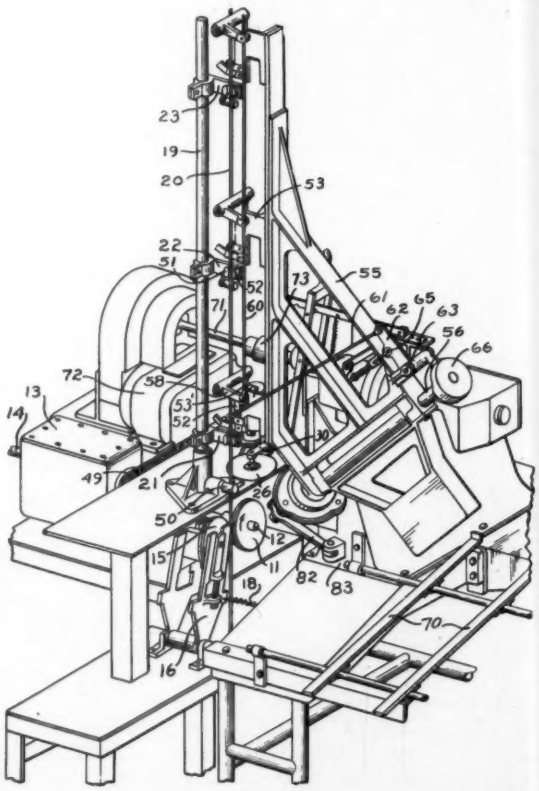

Fig. 7. Tube Cutting Machine.

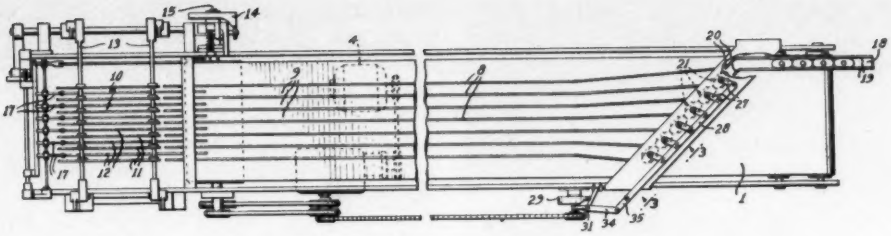

**Fig. 8. Bottle Arranging Machine.**

these assemblies is adjustable toward and from the sheet 16. Air currents are set up as shown by the arrows and a better quality of glass is produced as a result.

The patent contains three claims and 13 references were cited.

### Tube and Cane Machines

*Tube Cutting Machine. Fig. 7. Patent No. 2,597,272.* Filed March 16, 1949. Issued May 20, 1952. Four sheets of drawings. Assigned to Corning Glass Works by L. N. Pond and N. M. Wisner.

This is a machine for severing glass tube or cane as it comes upwardly from the drawing machine. The tube 20 passes upwardly between a drawing wheel 11 and a wheel 15, coming from a suitable source of supply. A vertical standard 19 has three arms 21, 22, and 23, each carrying a pair of rollers engaging the tube. When the desired length of tube has been drawn, an abrading wheel 26 scores the tube while moving up with it after which it returns out of contact with the tube to its lower position. Then a pair of chucks (not shown in the figure) grasp the tube above the score and move transversely to the line of travel of the tube and so break it at the score. A conveyor 55 swings about the shaft 56 turning the severed tube into horizontal position.

The patent contains eight claims and the references cited were 1,539,258, Graupner, May 26, 1925; 1,573,232, Ekstrom, Feb. 16, 1926; 1,996,387, Owen, Apr. 2, 1935; 2,195,625, Knaggs, Apr. 2, 1940; and 2,415,997, Eldred, Feb. 18, 1947.

### Miscellaneous Processes

*Bottle Arranging Machine. Fig. 8 Patent No. 2,596,319.* Filed Oct. 24, 1947. Issued May 13, 1952. Three sheets of drawings. Assigned to Emhart Manufacturing Company by Ludwig Wimmer.

This machine is intended particularly for rearranging oval or panel bottles that come to the machine in a single file, into a row extending at an angle across a conveyor for delivery to cartons. While the machine is primarily for handling filled bottles, the mechanism might perhaps be just as useful in arranging bottles on a conveyor for delivery to a lehr.

The bottles come to the machine in single file between guides 19 and engage a deflector 20 which turns them to an angle of perhaps 45° in a line across the conveyor 1. The bottles are then in position to be engaged by turning devices 21 which are operated by a cam mechanism. When the bottles are turned, they are released to travel on the conveyor 1. The turning mechanism is actuated by the engagement of the leading bottle with a trip mechanism.

The patent contains 11 claims and the only reference cited was 2,363,681, McNamara et al., Nov. 28, 1944.

*Method of Welding Glass Brick. Fig. 9. Patent No. 2,596,694.* Filed May 24, 1950. Issued May 13, 1952. One sheet of drawings. Assigned to Owens-Illinois Glass Company by Robert R. Kegg.

This invention aims to prevent the "reboil" which sometimes occurs when the two halves of a glass brick are welded. It also overcomes other defects which may occur in the manufacture of electric lamp bulbs and similar articles. This is done by the application of sulphur dioxide ($SO_2$) to the surfaces to be welded and this may be accomplished by mixing the $SO_2$ with the fuel used for softening the glass. The inventor does not fully understand the reason for the success of this method.

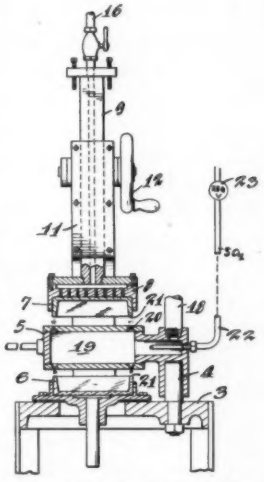

**Fig. 9. Method of Welding Glass Brick.**

The figure shows an apparatus something like that in the patent to Blau, No. 2,191,951. A burner 5 having ports to heat the edges to be welded receives its fuel from a pipe 18. The $SO_2$ gas comes through a pipe 22 having a regulator 23. This gas amounts to about 0.03% of the combustible gas.

One glass composition recommended for use with this method is:

| | |
|---|---|
| Silica, $SiO_2$ | 56.7 |
| Alumina, $Al_2O_3$ and iron oxide, $Fe_2O_3$ | 1.4 |
| Sodium oxide, $Na_2O$ | 4.2 |
| Potassium oxide, $K_2O$ | 8.0 |
| Lead oxide, PbO | 29.5 |
| Magnesium oxide, MgO | 0.1 |
| Calcium oxide, CaO | 0.1 |

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## WESTINGHOUSE TO BUILD LIGHTING EQUIPMENT PLANT

Westinghouse Electric Corporation has announced its plans for building a multi-million dollar industrial and commercial lighting equipment plant in Vicksburg, Mississippi. It is said that it will be the largest plant in the nation devoted exclusively to the manufacture of industrial incandescent and industrial and commercial fluorescent fixtures.

**W. G. Cole, Jr., Manager of the Fiber Glass Division of the Ferro Corporation of Cleveland, is shown at the wheel of the new custom-built sports car with a one-piece fiber glass-reinforced plastic body.**

### FIBER GLASS REINFORCEMENT USED IN "ONE-PIECE" AUTO

"Fiberflash", a custom-built sports car with a one-piece, fiber glass-reinforced plastic body weighing just about 185 pounds and yet several times stronger than steel, was unveiled recently by the Ferro Corporation. The lightweight plastic body is made of essentially the same composition as the new light armor suits U. S. combat troops wear in Korea, an armor that will stop direct hits by a .45 caliber slug.

"Fiberflash" was built by John Campbell of Cleveland, for W. G. Cole, Jr., Ferro's Fiber Glass Division Manager. The car body was designed and produced by Glasspar Company, Santa Ana, California. Mr. Campbell, who specializes in custom auto finishing, mounted the plastic body on a standard Henry J. chassis, using the six-cylinder engine with overdrive.

An outstanding feature of the plastic sports car body, besides its 185 pound weight, is its tremendous shock and impact resistance. Although the body is less than a quarter of an inch thick, ordinary impacts fail to do more than mar the finish. Only a major accident would result in damage to the car. Since the entire body is corrosion proof, weathering, salted streets or sea air will not cause rust. In case of a major crash, a crack in the body could be quickly remedied with a handy repair kit. Fiber glass and resin kits are purchasable with the auto. About 50 cents worth of material and less than an hour's time would do the repair trick, according to the announcement.

Mr. Cole described the composition of the plastic body as "a combination of fiber glass mat and woven fiber glass cloth, impregnated with a polyester resin to mold the body in one piece.

### SOLVAY DIVISION OF ALLIED CHEMICAL & DYE CHANGES NAME

According to a recent announcement, The Solvay Process Division and the Solvay Sales Division have been consolidated and will be known as the Solvay Process Division, Allied Chemical & Dye Corporation.

The division will be responsible for production and sale of alkali, chlorine and related products. A. B. Chadwick, now President of Solvay Process Division, will continue in that capacity and Carlton Bates will continue as Vice President in charge of operations. H. F. Merritt, now Executive Vice President of Solvay Sales Division, will become Vice President of the Solvay Process Division in charge of sales. L. B. Gordon, now Vice President of Solvay Sales Division, will become a Vice President of Solvay Process Division. No other change is contemplated immediately.

The executive sales office of Solvay Sales has moved from 40 Rector Street to 61 Broadway, New York City, to be consolidated with the Solvay Process executive office.

### OWENS-CORNING APPOINTS SCIENTIFIC DIRECTOR

The appointment of Harrison C. Blankmeyer as Scientific Director of the Fiberglas Research and Development Laboratories has been announced by Games Slayter, Vice President in Charge of Research, Development, and Engineering of Owens-Corning Fiberglas Corporation. Mr. Blankmeyer will assist Mr. Slayter in coordinating product development and process improvement programs carried out by some 550 technologists, technicians, and skilled artisans in the Fiberglas Research Laboratories and Pilot Plants.

A 1936 Chemical Engineering graduate of the University of Illinois, Mr. Blankmeyer is the author of several treatises on recovery of stack gases, alcohol production and industrial management. He collaborated in the invention of a process that instantaneously converts grain starches into fermentable sugars.

From 1937 to 1951, while employed by Joseph E. Seagram & Sons in Louisville, Mr. Blankmeyer served successively as a technical engineer, director of education, plant manager, technical director, services manager, and assistant to the vice president. Since early 1951 he has been assistant to the president of Kingan & Co., Indianapolis meat packing firm, where he established an industrial educational program in cooperation with Butler, Indiana, and Purdue Universities.

### HOVESTADT'S "JENA GLASS" REPRINTED

"Jena Glass, and Its Scientific and Industrial Applications", the classic text that may be said to have started modern glass technology, is now available in a complete copy of the English translation.

By arrangement with the Macmillan Company, this book has been lithoprinted and beautifully cloth-bound. It is for sale at the fixed contract price of $4.00 per copy, postpaid, in the United States only.

Orders should be addressed to Dr. S. R. Scholes, Head of the Department of Glass Technology, New York State College of Ceramics, Alfred University, Alfred, New York.

### The Use of Wire Resistance Strain Gauges and Polarizing Microscope to Determine Permanent Stresses in Tempered Glass

In many instances the polariscopic method of determining tempering stresses suffers from a limitation caused by the three-dimensional nature of the object to be studied. Thus, for instance, in the examination of glass containers with the polariscope, the polarized light passes through regions of glass containing differing stresses, and the observed optical effect is a composite of the effects of these differing regions. In order to circumvent this difficulty, by using shorter and more uniform light paths, the technique is frequently employed of cutting out small sections of glass from the commercial article and examining them in a polarizing microscope, preferably equipped with a quartz wedge or Babinet compensator. Resnick and Mould (*Journal of the Society of Glass Technology*, December 1951) show that the method of cutting out samples is incomplete without the inclusion of a term representing a release of stress when the constraints of one part of a three-dimensional structure upon another part are removed. A method of determining this stress was also presented.

Demonstration of the stress release invloves cementing a wire resistance strain gauge to the surface of the glass at the point where the tempering stresses are to be determined. When the section on which the gauge is mounted is removed, the gauge will indicate the amount of stress released. The tempering stresses can be formulated in terms of the stress released and the residual stress as measured with the polarizing microscope.

To derive the relations pertaining to this method, we shall consider a section of the surface and choose a coordinate system such that the $x$ and $y$ axes lie in the plane of the surface and are in the directions of principal stresses. Then the $z$ axis is perpendicular to the surface and the normal stress $S_z$ is zero at the surface. We can now write the following expression for the stresses and strains at the surface of the glass before the article is cut or broken.

$$E\epsilon_{0x} = S_{0x} - \sigma S_{0y} \quad (1)$$

$$E\epsilon_{0y} = S_{0y} - \sigma S_{0x} \quad (2)$$

where $\epsilon_x$ is strain in the $x$ direction; $S_x$ is stress in the $x$ direction; $\epsilon_y$ is strain in the $y$ direction; $S_y$ is stress in the $y$ direction; $E$ is Young's modulus; $\sigma$ is Poisson's ratio.

The subscript 0 indicates that the quantities are the initial tempering stresses and strains.

If we cut from the article a section including the portion of the surface under consideration, the stresses on the surface of the cut-out section can similarly be written as:

$$E\epsilon_{1x} = S_{1x} - \sigma S_{1y} \quad (3)$$

$$E\epsilon_{1y} = S_{1y} - \sigma S_{1x} \quad (4)$$

where the subscript 1 indicates stresses and strains after cutting out. Combining equations (1) and (2) with (3) and (4), we obtain the following expressions for the original principal stresses:

$$S_{0y} = S_{1y} - \frac{E[(\epsilon_{1y} - \epsilon_{0y}) + \sigma(\epsilon_{1x} - \epsilon_{0x})]}{1 - \sigma^2} \quad (5)$$

$$S_{0x} = S_{1x} - \frac{E[(\epsilon_{1x} - \epsilon_{0x}) + \sigma(\epsilon_{1y} - \epsilon_{0y})]}{1 - \sigma^2} \quad (6)$$

In these expressions the quantities $S_{1x}$ and $S_{1y}$ are the residual stresses as measured with the polarizing microscope. The quantities $(\epsilon_{1x} - \epsilon_{0x})$ and $(\epsilon_{1y} - \epsilon_{0y})$ are the strains released in cutting the specimen and are the quantities measured with strain gauges.

The difference between the original and the residual stress may be termed the stress release. The stress release at any interior point is a linear function of the distance from the surface of the glass, as can be shown to be valid from the following considerations: (1) The effect of releasing all the residual stress normal to a broken edge persists to a distance from the edge of only one thickness. (2) Any release beyond this distance is a result of either a bending, a stretching or a compressing, all of which produce a stress which is of linear function of distance from the surface. As a result of this linearity the original stresses before breaking may be obtained at any interior point in the glass by a combination of residual stress with the interpolated value of the released stress.

In order to utilize this method, it is necessary to cement strain gauges to both surfaces of a portion of glass. Then it is possible to determine both the original and residual stresses at both surfaces and the stress released at both surfaces. From these it is possible, by the principle of linearity, to find the stress released at any point within the glass interior, a result which, in conjunction with a knowledge of residual stresses throughout the glass, is sufficient to determine the value of tempering stress at any point in the interior of the glass between the two strain gauges. Accuracy is limited by the fact that the stresses may not be quite uniform over the area covered by the strain gauges and traversed by the light path. From the aforementioned consideration that the effect of releasing all the stress normal to a broken edge persists to a distance from the edge of only about one thickness, it can be deduced that the size of the cracked-out sample will have no effect upon the strain-gauge reading, providing it is larger than twice this critical distance, plus the length of the strain gauge.

The authors have compared the above theoretical outline with experiments on cylindrical tempered containers. In some cases, at least, the stress release is of the same order of magnitude as the residual stress. Enough tests have been made to show that the technique works, and that a combination of strain-gauge measurements and photo-elastic observations permits a more complete stress analysis to be made.

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• Dr. James A. Stavrolakis, Technical Engineer for General Electric Company at Oak Ridge, Tennessee, has been appointed a supervisor in the ceramics and minerals department at Armour Research Foundation of Illinois Institute of Technology.

# Current Statistical Position of Glass

**Employment and payrolls:** In the glass industry during April 1952, employment rose .9 per cent to reach a preliminary 122,500. This is in comparison with the adjusted figure for March of 121,000. During April 1951, employment was 132,200.

Payrolls during April 1952 were a preliminary $26,822,667. Compared with the previous month's adjusted payrolls of $34,973,033, a drop of 23.3 per cent is shown. Payrolls during April 1951 were $36,795,226.

**Glass container production** during May 1952, based on figures released by the Bureau of Census, for the first time this year rose to a 10 million figure. Production for May of 10,219,864 gross represents a rise of 7 per cent over the previous month's 9,523,038 gross. During May 1951 glass container production was 10,849,205 gross, or 5.8 per cent over May this year. At the close of the first five months of 1952, glass container production has reached a total of 46,866,128 gross. Compared with the 52,390,618 gross produced during the corresponding period of 1951, a difference of 10.5 per cent is shown.

Shipments of glass containers also rose to 10 million gross for the first time this year (the last 10 million shipment figure was August 1951) and was 10,127,697 gross. This represents a 6.3 per cent gain over the 9,523,038 gross shipped during April 1952. During May 1951 shipments were 10,702,352 gross, or 5.3 per cent higher than May this year. Total shipments of glass containers during the January-May 1952 period, have reached 46,120,371 gross. This is 6.9 per cent below the 49,564,831 gross shipped during the corresponding period during 1951.

Stocks on hand at the close of May 1952 were 9,871,257 gross. This is only a little less than the 9,862,618 gross on hand at the end of April. Stocks at the close of May 1951 were 9,426,382 gross.

**Automatic tumblers:** Figures for January and February 1952 for automatic tumbler production, shipments and stocks have been corrected and are as follows: *January:* Production, 4,882,873 dozens; Shipments, 4,472,982 dozens; Stocks, 11,836,503 dozens. *February:* Production, 5,136,363 dozens; Shipments, 5,514,484 dozens; Stocks, 9,988,546 dozens.

Automatic tumbler production for March 1952 was reported to be 5,357,141 dozens. This is an increase of 4.2 per cent over the 5,136,363 dozens produced during February. Production during March 1951 was 7,570,422 dozens. Shipments during March 1952 were 10,241,087 dozens, which is a drop of 8.2 per cent from the 5,514,484 dozens shipped during February. During March 1951 shipments were 7,156,777 dozens. Stocks on hand at the close of March 1952 were 10,241,087, or 2.5 per cent more than the 9,988,546 dozens on hand at the close of February. Stocks at the end of March 1951 were 10,340,140 dozens.

Automatic tumbler production for April 1952 dropped 12.2 per cent to reach 4,701,238 dozens from March production. Production during April 1951 was 7,533,507 dozens. Shipments for April 1952 fell off 1.4 per cent to reach 4,986,782 dozens from the 5,060,875 dozens during March. During April 1951 shipments were 6,851,240 dozens. Stocks at the close of April 1952 were 9,892,475 dozens, or 3.4 per cent below the 10,241,087 dozens on hand at the close of March. Stocks on hand at the end of April 1951 were 10,932,953 dozens.

**Table, kitchen and household glassware:** Manufacturers' sales of machine-made table, kitchen and household glassware during March 1952 was reported to be 3,431,390 dozens. This is 11 per cent below February sales of 3,857,152 dozens. Sales during March 1951 were 3,998,395 dozens. At the close of the 12-month period ending March 1952, manufacturers' sales totaled 38,403,404, which is 5.7 per cent less than the 40,739,232 dozens sold during the corresponding period ending March 1951.

**Foreign trade and export statistics:** The final 1951

**GLASS CONTAINER SHIPMENTS**
(All Figures in Gross)

| **Narrow Neck Containers** | May 1952 |
|---|---|
| Foods | 1,216,011 |
| Medicinal & Health Supplies | 1,072,094 |
| Chemicals, Household & Industrial | 597,961 |
| Beverages, Returnable | 939,835 |
| Beverages, Non-returnable | 37,450 |
| Beer, Returnable | 280,713 |
| Beer, Non-returnable | 674,018 |
| Liquors | 656,511 |
| Wines | 283,737 |
| Toiletries & Cosmetics | 535,990 |
| Sub-total (Narrow) | 6,294,320 |
| **Wide Mouth Containers** | |
| Foods | *2,593,756 |
| Dairy Products | 233,327 |
| Medicinal & Health Supplies | 328,809 |
| Chemicals, Household & Industrial | 136,980 |
| Toiletries & Cosmetics | 127,019 |
| Packers' Tumblers | 173,312 |
| Sub-total (Wide) | 3,593,203 |
| Total Domestic | 9,887,523 |
| Export Shipments | 240,174 |
| TOTAL SHIPMENTS | 10,127,697 |

* This figure includes Home Canning.

**GLASS CONTAINER PRODUCTION AND INVENTORY**
(All Figures in Gross)

| | | Production May 1952 | Stocks May 1952 |
|---|---|---|---|
| Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries & Cosmetics | Narrow Neck | 3,757,711 | 3,743,825 |
| | Wide Mouth | *3,254,226 | *2,881,168 |
| Dairy Products | | 202,845 | 282,089 |
| Beverages, Returnable | | 936,599 | 785,450 |
| Beverages, Non-returnable | | 38,071 | 41,663 |
| Beer, Returnable | | 296,265 | 335,988 |
| Beer, Non-returnable | | 580,462 | 631,493 |
| Liquors | | 692,877 | 782,000 |
| Wines | | 292,250 | 276,727 |
| Packers' Tumblers | | 168,558 | 110,854 |
| TOTAL | | 10,219,864 | 9,871,257 |

* This figure includes Home Canning.

export totals have been released by the Department of Commerce. Total exports of all classifications listed on the summary show an increase of 48.4 per cent for 1951 vs. 1950. Every classification of ware increased in both dollars and quantity, from 6.4 per cent for electric glass insulators to the largest, 162.3 per cent for glass fiber products. Canada continues to be the United States' best customer buying anywhere from 35 to 50 per cent or more of the glassware exported in each classification. The following is a 4-year summary of glass exports.

FOUR YEAR SUMMARY OF GLASS EXPORTS

| Description | % 1951 vs. 1950 | 1951 | 1950 | 1949 | 1948 |
|---|---|---|---|---|---|
| Auto. Machine Made Tumblers | 196.3 | $6,584,390 | $3,354,606 | $3,222,355 | $2,265,558 |
| Dozens | 185.7 | 13,141,121 | 7,078,263 | 6,365,164 | 4,244,968 |
| Average Price per Dozen | 105.7 | 50.1¢ | 47.4¢ | 50.6¢ | 53.4¢ |
| Hand Made Tumblers & Stemware | 110.2 | $ 63,979 | $ 58,034 | $ 73,035 | $ 88,615 |
| Dozens | 146.5 | 28,527 | 19,470 | 21,761 | 28,352 |
| Average Price per Dozen | 75.3 | $ 2.243 | $ 2,980 | $ 3.36 | $ 3.13 |
| Auto.Machine Made Table,Kitchen and Cooking Ware | 154.3 | $7,216,994 | $4,679,336 | $6,653,032 | $8,581,241 |
| Dozens | 137.2 | 8,212,326 | 5,987,380 | 8,562,386 | 11,739,991 |
| Average Price per Dozen | 112.4 | 87.9¢ | 78.2¢ | 77.7¢ | 73.1¢ |
| Hand Made Table & Kitchen | 133.0 | $ 366,064 | $ 275,200 | $ 273,720 | $ 319,481 |
| Dozens | 172.9 | 102,279 | 59,151 | 81,077 | 72,861 |
| Average Price per Dozen | 81.2 | $ 3.579 | $ 4.652 | $ 3.38 | $ 4.38 |
| Lamp Chimneys & Lantern Globes | 106.8 | $ 737,289 | $ 690,649 | $ 684,803 | $ 868,643 |
| Globes & Shades (Lighting) | 118.2 | $1,711,507 | $1,447,399 | $1,517,736 | $1,378,787 |
| Glassware Chemical,exc.Lab.Tub. | 139.5 | $2,477,995 | $1,776,512 | $2,040,693 | $2,697,607 |
| Elec. Glass Insulators | 106.4 | $ 293,275 | $ 275,719 | $ 201,626 | $ 343,215 |
| Glass N.E.S. - including: | 136.7 | $9,395,607 | $6,875,009 | $6,706,971 | $8,377,480 |
| Glass Tubes, Tubing, Rods, Canes | 141.7 | $3,308,709 | $2,335,241 | $2,144,604 | Reported as 529900 in 1948 |
| Elec. light Blanks | 119.0 | $1,887,845 | $1,586,170 | $1,887,044 | |
| Glass Fiber Products | 262.3 | $1,148,569 | $ 437,861 | $ 439,616 | |
| Glass Products N.E.S. | 121.3 | $3,050,484 | $2,515,737 | $2,235,707 | |

## TWO ALFRED FACULTY MEMBERS RETIRE

Two Alfred University faculty members, scheduled for retirement, were given honorary degrees at the University's 116th commencement.

Dr. Samuel R. Scholes, Associate Dean of the Ceramic College and Chairman of the Department of Glass Technology, and Dr. Ahva John Clarence Bond, Dean of the School of Theology, were honored. Dr. Scholes was awarded the Doctor of Science degree (Sc.D.), and Dean Bond received the Doctor of Letters degree (Litt. D.).

In citing Dr. Scholes, Dr. M. E. Drake, President of University, said, "As a teacher, your classroom and laboratory instruction has been an inspiration to generations of technology and engineering students. As an active delver into the mysteries of glass, you have made important contributions in extending the boundaries of this field of knowledge. As an administrator, you have rendered outstanding service in the development of your college."

## REFRACTORIES INSTITUTE ELECTS OFFICERS

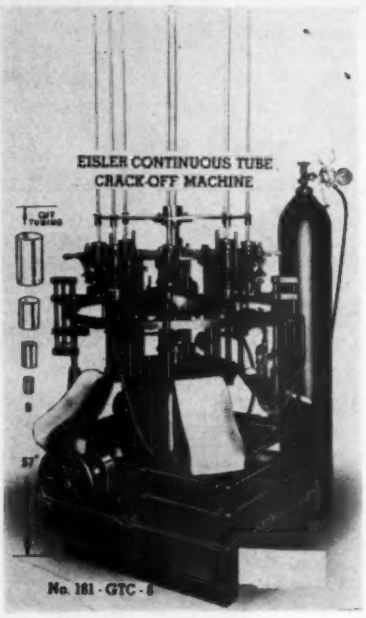
James L. Crawford, President of Walsh Refractories Corporation, was unanimously re-elected President of The Refractories Institute for a further term of one year at the annual spring membership meeting. W. A. Turner, President of The McLain Fire Brick Company, was re-elected Treasurer.

It was also announced that the Institute is undertaking to compile and publish for wide distribution a Product Directory of Refractory Manufacturers in the United States. The last edition of such a directory was in 1942 and there have been many company and product changes since that time.

The 1952 edition will include, for the first time, a section devoted to the optional product classification by A.S.T.M. standards or by the manufacturer's designation of the quality of his product. The directory will also include the names and office addresses of all refractory manufacturers, plant locations, brand names of products and divisions of the refractories industry.

**CORRECTION:** In the April issue of THE GLASS INDUSTRY, Page 212, it was incorrectly reported that the new Chance Brothers factory at Firhill, Glasgow, was producing the only fluorescent light tubing in the United Kingdom. However, also producing this type of ware are Osram-G.E.C. Glass Works, Middlesex, England, and The British Thomson-Houston Export Co., Ltd., Rugby, England.

# New Equipment and Supplies




## HIGH SPEED GLASS TUBING CUT-OFF MACHINE

Eisler Engineering Co., Inc., 750 South 13th Street, Newark 3, New Jersey, has announced the development of a high-speed 8-head automatic glass tube cutting machine for use with soft glass tubing, lime, lead glass or similar glass tubing. The machine can be adapted for diameters from ⅛″ to 1″ (or 3 to 25 mm.) and the length of the cut pieces from ¼″ to 6″.

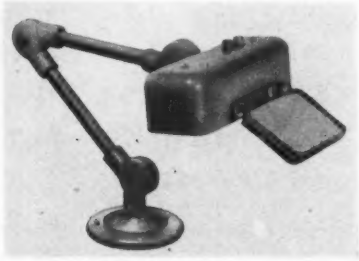
The principle operation of the machine is based on creating a strained section of the tubing where severed end is required. This strained section is consequently cracked off by a dampened carborundum stone, causing a clean and square cut. The machine is capable of handling 5 ft. lengths of the tubing. One operator can handle several machines.

The machine base carries speed reducer, counter shafts, and the geneva indexing mechanism. The 8-head turret revolves intermediately, while the chucks rotate contiuously. Four strain fires and shock wheels are located circumferencially. Glass tubing is lowered automatically after every crack-off while the severed piece of tubing drops into a chute. The machine may be adjusted to cut four different lengths at the same time.

## NEW UNIT FOR AUDIGAGE THICKNESS TESTING

Branson Instruments, Inc., 430 Fairfield Avenue, Stamford, Conn., has announced a new magnetic fixture for use with its ultrasonic Audigage Thickness Tester. The new accessory assures good contact and prevents accidental shifting of the searching unit during tests, and permits one man to operate the instrument alone in different locations. It is particularly valuable when working on ladders or staging, and when test points are beyound easy reach, such as tank bottoms and sides.

The fixture consists of a flat spring with an Alnico permanent magnet coupled flexibly to each end, and means for attaching the searching unit quickly and easily to its center. Good contact is essential in ultrasonic thickness testing because a frequency-modulated signal must be transmitted into the non-porous material and its frequency adjusted until it equals the natural frequency of the particular thickness being measured. Resonance then occurs and is indicated by an audible tone and deflection of a meter. The actual thickness corresponding to the resonant frequency can be read from a conversion scale on the instrument panel.



## ILLUMINATED MAGNIFIER

Stocker & Yale, Inc., Marblehead, Mass., has announced a new portable high-intensity fluorescent fixture designed primarily for industrial inspection producing intense but cool glare-free illumination with high magnification.

Model 66SV is equipped with either a 2 or 4 power lens of 2″ x 4″. The lens holder is hinged, offering the inspector complete versatility of using the light with or without the lens. The lens also acts as an ideal chip shield when in use. Up to 500 Foot candles of intense illumination is provided yet the lamp shade never gets hot.

*Wheelco Instruments Division*, Barber-Colman Company, Rockford, Illinois, has issued Bulletin T/C 9, the new 1952 edition of the Wheelco Data Book and Catalog containing prices, application recommendations and pertinent information concerning instrument sensing units and associated accessories.

Essential data pertaining to making, checking, selecting and ordering thermocouples, wire sizes and resistances and temperature-millivolt curves are included in the booklet.

## CATALOGS RECEIVED

*Selas Corporation of America*, Philadelphia 34, Pa., has announced publication of two new bulletins, Bulletins SC-1000 and SC-1006.

Subjects of the first bulletin are multiport flame type gas burners used in heat processing such as glass fire polishing; high temperature alloy brazing; baking; tempering and hardening; heating solder pots, core ovens and die molds. Capacities and specifications are given with appropriate dimensional drawings.

Bulletin SC-1006, "Selas Automatic Fire Checks and Safety Blowouts—Combustion Safeguards," describes fully two protective devices used in the piping systems of gas-air combustion systems. The automatic fire check is used to detect, localize and extinguish a flashback in the gas-air mixture lines, close to the gas burners. The safety blowout is used to prevent damaging flashbacks in the main supply piping from damaging combustion control equipment and to relieve excessive flashback pressures by diverting the shock forces safely.

*Overmyer Mould Company*, Winchester, Indiana, keynoting its 50 years as mould makers, has issued an interesting history of its progress since 1901.

Opening with a message by C. P. Overmyer, President of the firm, the booklet goes on to illustrate and describe early operations of the firm, highlighting factory expansion and improvement. This is followed by illustrations of the various departments necessary in the process of mould making and the booklet closes with photographs of the company's branch plants.

*Minneapolis-Honeywell Regulator Company*, Brown Instruments Division, Wayne and Windrim Aves., Philadelphia 44, Pa., has issued Bulletin Index 100-A, which is an index of technical literature available from the company's Industrial Division.

The bulletin consists of both a numerical listing and alphabetical cross-index for specification sheets, instrumentation data sheets, catalogs and other literature previously released. Included in the alphabetical index are articles from *Instrumentation*, the manufacturers quarterly publication.

*Bausch & Lomb Optical Company*, Rochester 2, New York, has published a 24-page guide, entitled "Industrial Magnifiers—How to choose and use Them."

The booklet outlines the optical principles of magnifiers in easily understandable language, describes the basic types, tells how to use and care for them, and includes a magnifier selector chart and glossary.

*Illinois Testing Laboratories, Inc.*, 420 N. LaSalle Street, Chicago 10, Illinois, has issued a bulletin devoted to a new temperature control unit, Alnor Pyrotac.

The folder discusses the principles of the unit, its operation and particular features.

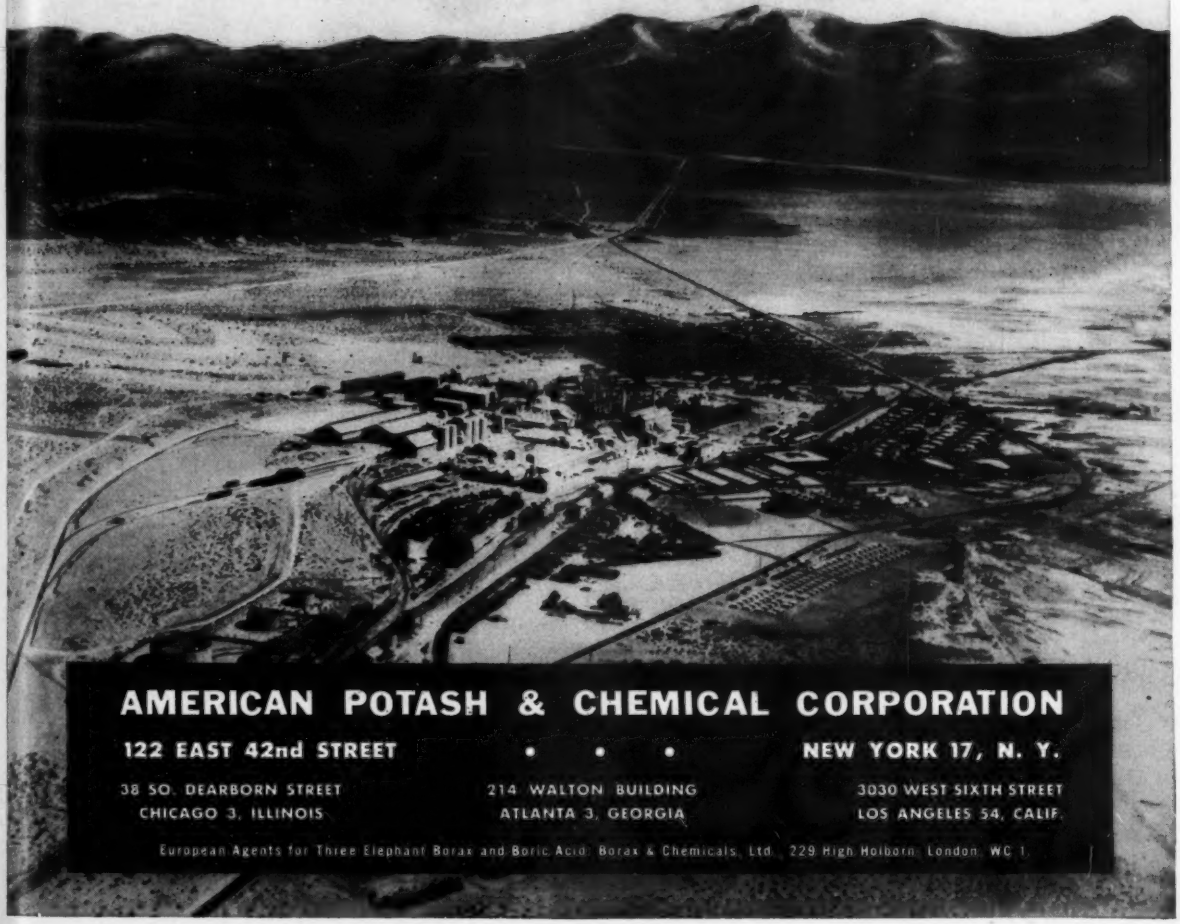
# Specify THREE ELEPHANT

**BORAX**

**BORIC ACID**

**PYROBOR**
*Dehydrated Borax*

**LITHIUM CARBONATE**
*Technical*



**AMERICAN POTASH & CHEMICAL CORPORATION**

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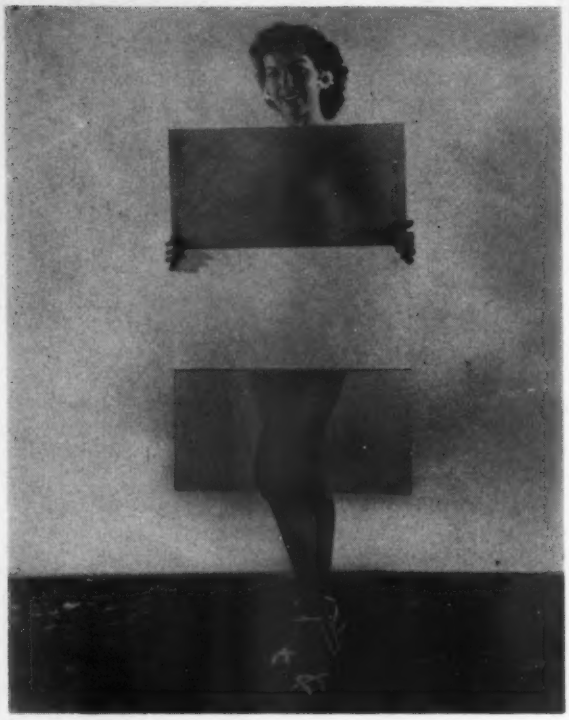
ATLANTA 3, GEORGIA

3030 WEST SIXTH STREET
LOS ANGELES 54, CALIF.

European Agents for Three Elephant Borax and Boric Acid: Borax & Chemicals, Ltd., 229 High Holborn, London, WC 1.



**FIBER GLASS BUILDING PANEL**

Alsynite, manufacturer of the original translucent fiber glass building panel, now has developed two new types of sheeting, as displayed here by Marion Heatherly, winner of the "Miss Collegiate of Southern California" title.

The top section is the original translucent panel which admits light without being transparent and is available throughout the United States. The other two panels are the newly-developed opaque (center) and transparent (bottom), which will enter production soon. The lightweight, shatterproof sheets, can be sawed or nailed like wood and are used in a number of decorative and structural applications.

## FOOTE ANNOUNCES RUTILE SUBSTITUTE

Foote Mineral Company, processors of minerals and ores, has announced a new product, "Tanarc," as a substitute for critically short natural rutile.

Tanarc, containing approximately 70% titanium oxide is a specially compounded material which is being successfully used in many industrial applications formerly requiring rutile. This is of special importance to welding rod manufacturers using electrode coating materials.

## COMMITTEE C-14 WORKS ON NEW STANDARDS

Considerable activity was reported in the field of test methods for measuring physical and mechanical properties of glass and glass containers at a recent meeting of Committee C-14 on Glass and Glass Products of the A.S.T.M.

Methods are being reviewed for measuring thermal expansion, annealing and strain point, and softening point, and it is hoped to present proposed A.S.T.M. methods at the fall meeting of the Committee. Meanwhile, a round-robin test series will be inaugurated to establish the value of selected test methods.

A special group is studying the existing A.S.T.M. Method for Testing Flexure of Glass (C 158). It is planned to include further clarification of the significance of this test method in respect to its use as a criterion for establishing the quality of the glass. The development of an impact test method has been proposed and will be given further study.

Attention was called to the need for a change in the Tentative Method of Sampling Containers (C 224 T). A change in the time schedule noted in Table I of this method is definitely needed in order that the schedule may more truly represent industry practice.

## THATCHER GLASS AND GBBA CONTRACT INCREASES WAGES AND BENEFITS

After two days of discussion at the Hotel Sherman in Chicago, representatives of the Thatcher Glass Manufacturing Company and the Glass Bottle Blowers Association of the United States and Canada agreed on total benefits of more than 6½¢ in accordance with a reopening clause in the existing contract which expires next September 1.

Agreement on the increased benefits was reached on June 4, 1952 and is, of course, subject to approval by the Wage Stabilization Board. The company-wide increase was granted in behalf of the GBBA Unions, Miscellaneous Locals 180 at Elmira, and 42 and 174 comprised of Thatcher employees at its plants at Lawrenceburg, Indiana, and Streator, Illinois.

Under the new terms and retroactive to May 26, 1¢ per hour is to be added to all present base rates of pay and, in addition, 3.6% per hour figured on the total to the nearest half cent, adding up to about 6¢ per hour.

Additional benefits give all employees who have been with the company 25 years or more a total of 3 weeks vacation (144 hours), starting next September 1. Any employee suffering a death in his immediate family (wife, husband or child) will receive full pay for a period of two regular shifts or two full days. According to Thatcher executive vice-president F. K. Rodewald, the last two named benefits have not been granted before in the glass container industry and is in line with Thatcher's industry-leading policy which resulted several years ago in an extra day's pay for each vacation week.

## INDUSTRIAL INSTRUMENTATION SEMINAR SCHEDULED FOR AUGUST

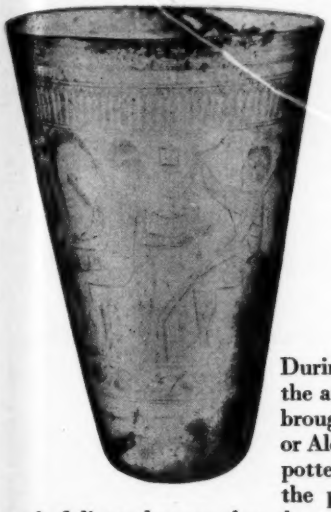
The third annual seminar in industrial instrumentation will be held for professors of engineering in Philadelphia, August 18 to 22, according to an announcement by the Industrial Division of the Minneapolis-Honeywell Regulator Company.

According to M. J. Ladden, training supervisor for the company's Brown Instruments Division, the five-day program is designed to familiarize the faculty of engineering schools with recent advancements in industrial processes and the attendant development of automatic instrumentation. This phase of engineering, he explained, is covered only on a broad basis in the conventional curriculum. The program will also include discussions of mutual problems of engineering colleges and the instrument industry.

*Ceramics and Man through the Ages*

# ROMAN GLASS

## MORE PRECIOUS THAN GOLD



*Cameo Glass Vase, 1st century A.D. (Left) Worringen Engraved Glass Beaker, 3rd century A.D. Gift of Edward Drummond Libbey, Toledo Museum of Art. (Below) Portland Vase, courtesy, Trustees of the British Museum, London.*

During the reign of Tiberius, the art of glass blowing was brought to Rome from Sidon or Alexandria. Many former pottery workers turned to the production of glass of such delicate beauty that the emperor Nero is known to have paid 1,000,000 sesterces ($250,000) for one small cup. To this day, the Romans have had no superior in glass making.

Applying the cameo technique to his art, the Roman glassworker shaped a deep-blue vase with his blowpipe, then dipped it into opaque white liquid glass. When thoroughly hard, the white layer was cut away, leaving raised white figures in relief against the dark ground. In offering to sell such a vase in 1929, the Duke of Portland rejected, as too low, a bid of $152,000. Few art collections in the world are more precious than those of Roman Glass.

Unlike the Romans, modern glassmakers can step up production and improve their products with ALCOA Alumina. Its constant high purity and uniform particle size facilitate quality control and batch mixing.

ALCOA Alumina gives glass *strength* . . . *sparkle* . . . *clarity* . . . *resistance* to chemical attack, thermal and mechanical shock. Moreover, ALCOA Alumina in glass tank refractories adds to their life. It can add sales appeal to *your* product . . . increase *your* profits . . . turn *your* glass to gold.

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**FREE:** For a free chemical analysis of Roman glass, write to ALCOA on your company letterhead. (Fragment for analysis, courtesy of the Toledo Museum of Art.)

### WELL-PLANNED MERCHANDISING EXPERIMENT DOUBLES GLASSWARE SALES FOR S. H. KRESS COMPANY

A new idea in variety store glassware merchandising, tested recently by the S. H. Kress store on Fifth Avenue in New York City, paid off with results which have aroused nation-wide interest among both retailers and glassware manufacturers.

Sales volume more than doubled on many items featured during the test period of two weeks beginning April 21, a time deliberately chosen because it represented a usually dull period for glassware, coming shortly after Easter and the Passover season.

Focal point of the experiment was a window display, built upon the theory that moderately-priced glassware would have greater appeal for the customer if she could see it as it would appear in her home, and that this greater appeal would result in increased sales and profits.

The idea was developed jointly by Kress store officials and representatives of the Glassware Institute of America. It was felt that the customer does not get the full impact of value offered by moderately-priced glassware from her view of it in the necessarily crowded display counters of the glassware department.

The ultimate solution was the use of table-setting pictures, blown up to display proportions and used as a background for a relatively simple window display. The three pictures, using items chosen from Kress stock, illustrated a table of formal feeling, a backyard picnic scene, and a frilly, feminine setting of the bridge dessert type. Items pictured were displayed in neat rows in front of the photograph with prices noted.

Regular studies of the window's drawing paper were made and it was found that an average of 12 persons per minute stopped to look at the merchandise. During the heavy traffic hours, like the noon rush, there were as many as 80 in five minutes, not including people who slowed down to scan the window as they walked by.

To make the items displayed stand out sharply, a black floor and background and abandoned mirrors and glass platforms were used. The GIA slogan, "Glassware for Gracious Living," was used, displayed in a white script hanging cut-out.

B. M. Kerns, Manager of the Glassware Department, reported a general step-up in sales all through the department, with remarkable increases on many of the items in the window. An Early American pressed glass pattern caused considerable comment. Mr. Kerns reported that scores of people told them that they had looked all over for such a pattern and had been unable to find it. Kress store had it in stock for months, as do hundreds of other stores. Again, the merchandising experiment scored a point.

### LACLEDE-CHRISTY EXPANSION

Laclede-Christy Company has announced that it has leased the plant and facilities formerly owned by the Blackmer & Post Pipe Company, one of the largest manufacturers of vitreous sewer pipe in the St. Louis area.

The company contemplates some improvements on the leased property, it was learned. Laclede-Christy contemplates capacity operations for the balance of this year as soon as the equipment can be reactivated.


• DESIGN
• ERECTION
• OPERATION

of Glass Plants

DOMESTIC AND FOREIGN

Complete Glass Plants and Equipment, Batch Systems, Glass Melting & Sodium-Silicate Furnaces, Batch Feeders, "Schmid" Mechanical Gob Feeders, "Liberty" Pneumatic Gob Feeders, Automatic Handling Equipment, Stackers, Lehrs, Machines, etc. for manufacture of containers, flat glass, pressed ware, and tubing. Furnace Repairs and Rebuilding. Process Engineers.

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# how another glass manufacturer uses MONOFRAX refractories

UNDER CONSTRUCTION — a five port, oil fired, amber container tank.

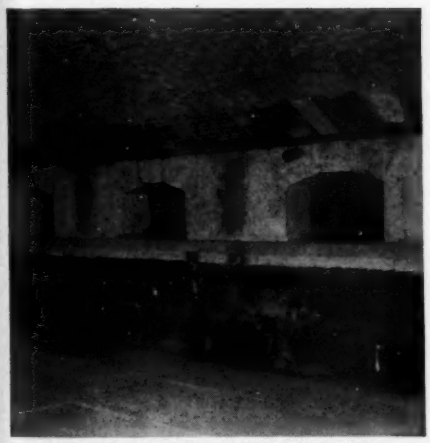
This new amber container tank is made largely of MONOFRAX fused cast refractories. Like many recently completed tanks, this installation follows extensive panel testing.

Applying the results from similar tests, more and more operators are using MONOFRAX refractories. It is therefore interesting to see where — in different tanks making different glasses — these special, heavy duty refractories are being placed.

This operator, for example, put MONOFRAX refractories in the following areas:

**TYPE K** — in the melting end, including sidewalls, backwall, bridgewall and throat; throat flankers in refining end bridgewall; and an 18" bottom bench course in the melting end, doghouse, throat and bridgewall. It is used in these sections because Type K gives greatest resistance to erosion at metal line and joints as well as to upward drilling.

**TYPE H** — in the doghouse superstructure, including gable wall arch over doghouse opening; port sills, tuckstones, and plate tile; port jambs and entrance arches; complete overhead burner block assemblies; and the breastwall blocks. This material was developed just for superstructure work. It not only stands up under the high temperatures required to melt glass but also is extremely resistant to heat shock and chemical attack.



COMPLETED — a section of the completed tank. The metal line is 33".

All of which will help give a longer campaign and top quality glass — advantages that the right combination of MONOFRAX refractories can give you. Why not have one of our engineers make recommendations for your tanks? Our address: Dept. L-72, Refractories Div., The Carborundum Co., Perth Amboy, N. J.

***Use fused cast refractories by***

# CARBORUNDUM

Trade Mark

*"Carborundum" and "Monofrax" are registered trademarks which indicate manufacture by The Carborundum Company.*

**NON-ALKALI AND HIGH MANGANOUS OXIDE GLASS . . .**

(*Continued from page* 355)

*B. Chemical durability.*

Sample was glass fiber with 7-9$\mu$ diameter, and result of weathering and chemical durability test is shown in Table VII.

According to the results of the thermal durability and weathering test based upon the testing method which is specified in the Tentative Japanese Standards,[6] this new glass stands comparison with borosilicate glass. Also, in chemical resistance against acid and alkali, the former is found to far surpass the latter.

**Conclusion**

In view of the fact that Japan lacks boron resources, composition of glass containing no boron and no alkali was studied, aiming to manufacture glass for electrical insulating materials to substitute for borosilicate glass. For procedure to derive such glass composition, a melting diagram of ternary system, anorthite-diopside-rhodonite, was experimentally obtained, and from such diagram, a glass composition range, which has low melting temperatures and yet is likely to form stable glass, was determined.

As the primary aim of application of this glass was to manufacture glass fiber used for making electric materials, a specific glass composition in the said range was given additional silica to adjust viscosity and fluidity, so that the glass might have properties suitable for spinning conditions of borosilicate glass hitherto in use, and thus, required glass composition for spinning fiber was determined to be $SiO_2$ 55%, $Al_2O_3$ 11%, CaO 17%, MgO 7% and MnO 10%. This non-alkali and high manganous oxide glass, which is an entirely new composition, has electrical and chemical properties favorably comparing with borosilicate glass, and possesses a high utilization value as material for manufacturing of insulating and chemical glass products.

This research has clarified that, by utilizing manganous silicate, namely, rhodonite, which plentifully occurs as mother rock in manganese deposits, glass with desired amount of manganous oxide content can be easily produced.

REFERENCE

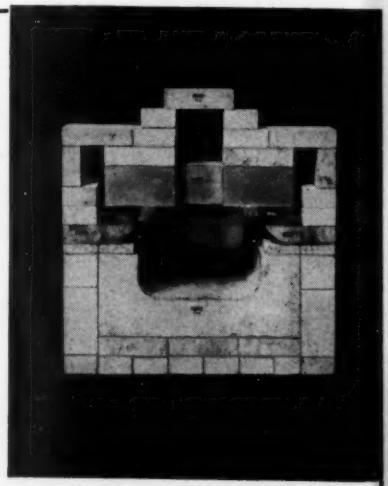
1. H. Kalsing and M. Thomas, Glastech. Ber., 18, 210-212 (1940).
2. O. O. Anderson, Amer. Jour. Sci., [4] 39, 407-434 (1915).
3. B. Yoshiki and R. Yoshida, Jap. Pat., No. 161,235 (1943).
4. N. L. Bowen, Amer. Jour. Sci. [4] 40, 161-185 (1915).
5. E. Voos, Zeit. anorg.u. allgem. Chem., 222, 201-224 (1935).
6. Tentative Japanese Standards on Glass Fiber for Electrical Insulation. No. 283 (1942).

**CHAS. TAYLOR SONS NAMES REPRESENTATIVE**

The Chas. Taylor Sons Company, a subsidiary of National Lead Company, has announced the appointment of Donald K. Schleiffarth as their exclusive representative for the States of Missouri, Kansas, Oklahoma and Southern Illinois.

Mr. Schleiffarth has been associated with Standard Oil Company of Texas, later becoming associated with his father, Armin O. Schleiffarth, a well-known manufacturer's agent.

*Cleaner Glass, Low Maintenance with* **CRYSTALITE Forehearths**



REMMEY CRYSTALITE (mullite-bonded mullite) is produced in all shapes necessary to make up the forehearth assembly. Burner blocks, cover blocks, channels, spouts, tubes, plungers and orifice rings are built to meet specified requirements. These CRYSTALITE parts mean better, more efficient production by offering:

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## UNIVERSITY OF TOLEDO AND GLASS COMPANIES SPONSOR GRADUATE INSTITUTE IN SILICATE CHEMISTRY

Establishment of a Graduate Institute in Silicate Chemistry and Related Sciences has been announced jointly by the University of Toledo and three Toledo glass companies. Initial sponsors of the Institute are Libbey-Owens-Ford Glass Company, Owens-Illinois Glass Company, Owens-Corning Fiberglas Corporation and the University.

The program outlines what has been termed the only "graduate institute devoted exclusively to basic research and instruction in application of physical chemistry to silicate technology." The institute will be financed initially by grants totaling $75,000 from the industry and $50,000 from the university over a five-year period. The university anticipates that $50,000 in additional funds will be available from other companies which can profit from research in the silicate field.

Heading the institute will be Dr. Wilhelm Eitel, an outstanding scientist in silicate chemistry. Dr. Eitel's work will be directed through a technical advisory committee representing the sponsoring firms and the university. David H. Goodwillie, former executive vice president of Libbey-Owens-Ford, has accepted chairmanship of the committee.

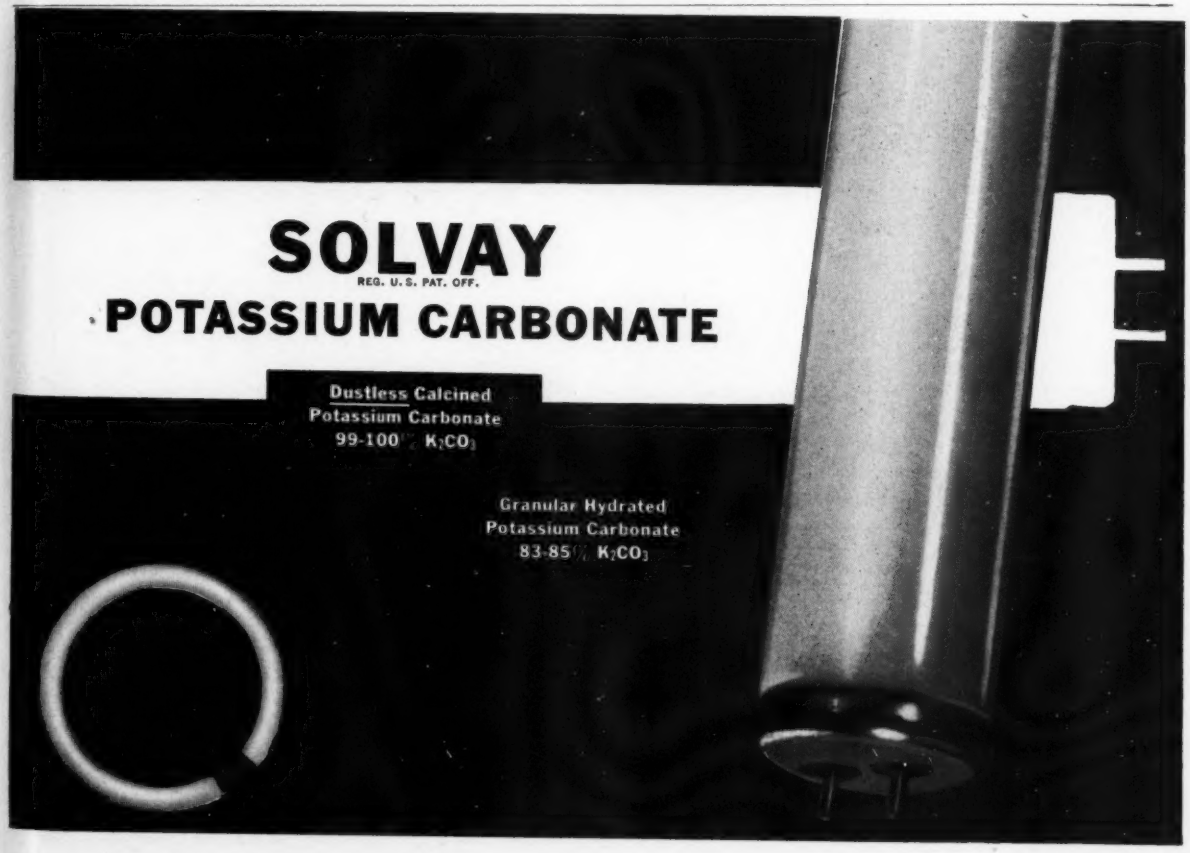
Activities of the institute will include basic research problems, with facilities available for carefully selected graduate students to work toward graduate degrees. The purpose is to allow Dr. Eitel and his associates to carry on this research, to write and to lecture.

## O-I STREATOR PLANT ELECTS GBBA

The Glass Bottle Blowers Association (AFL) have won a outstanding victory at the Owens-Illinois plant in Streator, Illinois. In a run-off election, they defeated the CIO Glass Ceramic and Silica Sand Workers Union by a vote of 668 to 570 with 60 ballots challenged.

Thirteen hundred workers voted in the election to approve the Glass Bottle Blowers Association as their bargaining representative. For seven years they had been represented by District 50, an affiliate of the United Mine Workers of America, IND. Recently an election was ordered by the National Labor Relatons Board which included on the ballot the choice of the Glass Bottle Blowers Association (AFL), the CIO Union, and "No Union." The vote necessitated a run-off election between the Glass Bottle Blowers and the CIO Union.

The second vote was held June 10th and 11th and the Glass Bottle Blowers Association won a clear majority. For many years 120 machine operators at the Streator plant have been members of the Glass Bottle Blowers Association as have 11,000 other employees of the Owens-Illinois Glass Container Plants in Illinois, New Jersey, California, Pennsylvania, West Virginia, Indiana and Texas. With the addition of the 2500 workers at the Streator plant, the membership of the Glass Bottle Blowers Union, which has been steadily rising, is now 45,500, the highest in its history. Lee W. Minton, President of the Union, had high praise for the work of the Glass Bottle Blowers Association organizers and officials in Streator.



(*Continued from page 353*)

Figure 3 shows tumblers passing in front of a newer type ribbon burner for this purpose, on rotating spindles. Multiple burners are normally required, and may be placed at both sides if structure permits. Ribbon burners derive their name, of course, from the fact that they deliver continuous "ribbons" of flame. Lines of flame-retaining alloy blast tips and other suitable ribbon burners are also used for this operation. Firing is sometimes accomplished from above, but this is usually advisable only for indexing type fire polishing machines.

*Hollow Pressed Ware.* Certain items in this category are glazed from above, and among these are electric meter cases and glass building blocks. These have nearly smooth surfaces, which are very satisfactorily clarified and made lustrous by blasting downward from single-high-input (not high velocity) burners, as shown in Fig. 4. Here also the ceramic-lined combustion chamber completely solves the problem of flame retention and minimizes flame "spill." Although not always so handled, this operation is particularly well suited to an indexing type conveyor.

*Baking Dishes, Cups, Refrigerator Dishes.* These classes of ware are nearly always pressed and then fired along top edges. In one of the most advanced fire polishing installations, burners and flame patterns are matched to ware top contours, either round or rectangular. Beneath these specially shaped burners firing downward, ware is indexed from one station (burner) to the next. Few applications compare with this in performance and operating economy. This is illustrated in Fig. 5. Household ware which must withstand thermal shock is usually of borosilicate glass, and this must be heat processed at higher-than-usual temperatures.

*Plates and Platters.* A leading producer of handmade ware glazes plates and shallow dishes in a rather unique but effective manner. Ware is first preheated during rotation under an individual radiant burner roof, and then transferred and rotated again beneath a roof sending down a controlled pattern of sharp blue flames for surface fusion. As an alternative handling method, roofs rather than ware may be transferred. This equipment has replaced conventional glory holes in which ware had been in greater danger of losing shape from overheating. Previously, acid polishing had been found to etch the glass non-uniformly. The new equipment is portable, and conserves fuel.

*Stemware.* Much stemware in production shops is being polished by acid immersion or by rotation against spinning brushes and water-borne abrasive powders. Both of these methods are costly, relatively slow, and must be done away from the production line.

Where it is desired to glaze over-all surfaces of irregular shapes, heavier types of ware are often bathed completely in soft flames. Because use of such flame "baths" does not permit adequate process control, this method is not employed for more than delicate items.

If a satisfactory fire polishing method can be developed for fine stemware, all of these disadvantages can be offset. At the present time progress is being made in this direction, and there is reason to believe that a successful process will be developed.

*Articles Formed from Rod, Tube and Sheet Glass.* Many small glass shops are engaged in fabricating articles from glass rod, tube and sheet. Fire polishing in these plants usually consists of removing sharp cut edges, frequently by rotating the piece in the flame. This can usually be done with fairly simple burner equipment, and involves the use of blast tips, "fish tail" tips or ribbon burners playing on the edges. Figure 6 shows the use of two ribbon burners under a glass stirring rod. In this operation, the length of the flame exposure controls the diameter of the ball on the end of the rod. A somewhat similar heating operation is employed in the manufacture of glass thermometers.

*Small Glass Spheres.* Largely used in reflective paints, small glass spheres are made in large quantities by fire polishing finely crushed glass particles. Although methods used to form these spheres are often carefully guarded secrets, it is general requirement that the glass particles pass through a sufficiently intense flame and solidify before touching materials to which molten glass will adhere. A reasonably successful method is reported to be one in which finely crushed glass is introduced to the unburned gas-air mixture stream, permitting maximum time of flame contact.

### Gas Enrichment

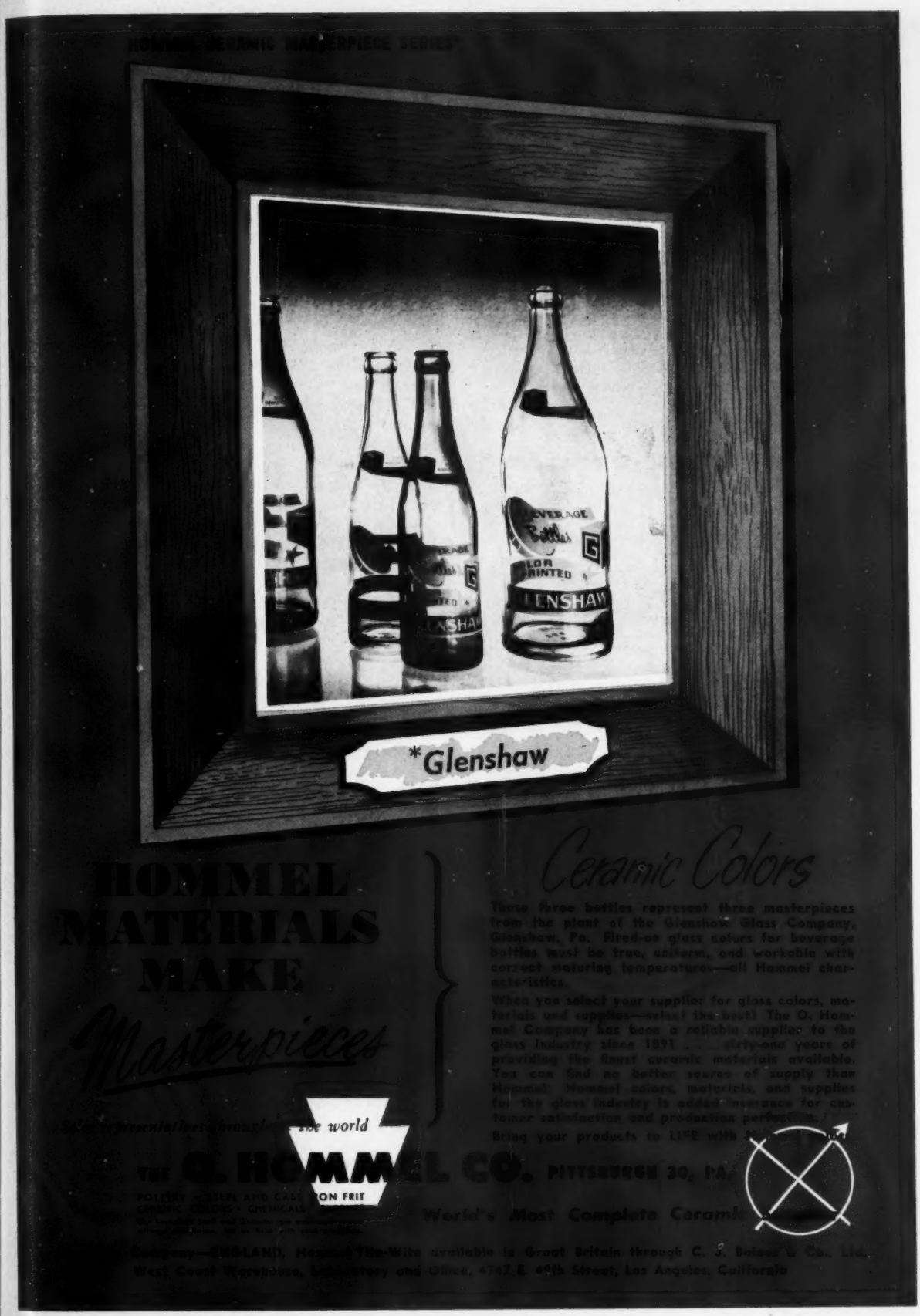
As natural gas lines have reached into new industrial areas, glass plants there have in numerous cases experienced difficulty in maintaining performance of fire polishing operations, due to lower burning speeds than those obtained with manufactured gas and air. Slower combustion of natural gas and air results in larger flames with the same Btu and air input, because more time and space are required for it to burn. Cycle time *for heating by flame contact* may be increased approximately ten per cent.

Heating speeds may be restored in some cases by employing burners and combustion equipment of new design. At times, however, plants have found it undesirable to change all burner equipment, and have elected to enrich natural gas with hydrogen or combustion air with oxygen. Either method will restore combustion speeds, and selection is a matter of economics. Hydrogen is being satisfactorily and automatically added, in proportions of twenty to thirty per cent, through motor driven mechanical mixers. This is illustrated diagrammatically in Fig. 7. Oxygen on the other hand is usually introduced through suitable inspirators placed close to the burners.

### Fire Polishing Machines

Because by far the larger volume of glassware is machine-made, most fire polishing is also performed on conveyorized machines, to a large extent completely automatic in operation. Many of these machines are portable, so they may be moved wherever needed. While some convey parts horizontally with or without rotation, much tableware is fire polished on traveling vertical spindles in rotation.

Downtime in a glass plant is so costly that machines should be built with carefully protected bearings, gears and other vital parts. A shortcoming still often found, however, is that in the event a machine becomes jammed with crushed ware, breakdown occurs. Development of machines which will clear themselves under these circumstances will be welcomed by glass production men.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HOMMEL MATERIALS MAKE Masterpieces
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These three bottles represent three masterpieces from the plant of the Glenshaw Glass Company, Glenshaw, Pa. Fired-on glass colors for beverage bottles must be true, uniform, and workable with correct maturing temperatures—all Hommel characteristics.
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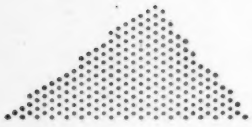

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*standard and custom-built machinery for glass working, forming, shaping*

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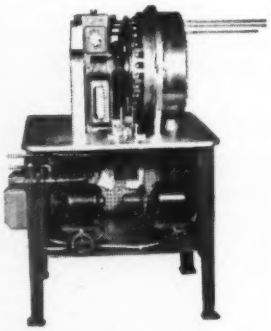

#1507 High Speed Automatic Glass Tubing Cutting Machine. For soft glass tubing; produces up to 15,000 pieces per hour.

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Cut costs, increase production, assure uniformity with Kahle equipment for manufacturing: ampules • cathode ray tubes • standard, miniature, sub-miniature radio tubes • G D S B • fluorescent lamps • incandescent lamps • photocells • x-ray tubes • glass products •

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## LACLEDE-CHRISTY OFFICER ELECTIONS

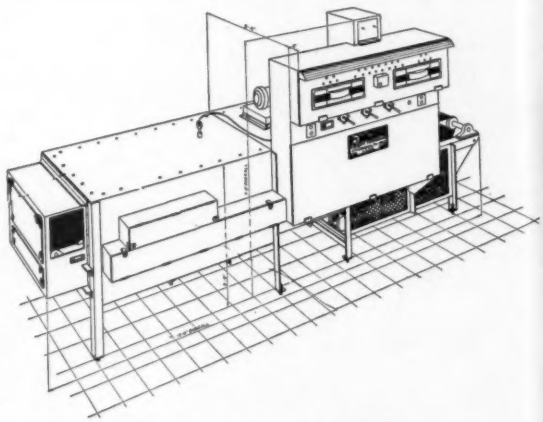
At the annual meeting of stockholders of Laclede-Christy Company, the following directors were re-elected: A. B. Agnew, Wm. H. Armstrong, J. LeBeau Christy, Wm. P. Hemphill, Walter W. Shipley, J. D. Streett, and J. Gates Williams.

At the annual meeting of directors, held at the same time, the following officers were elected: J. D. Streett, President; A. B. Agnew, J. L. Cummings and L. C. Hewitt, Vice Presidents; Walter W. Shipley, Vice President and Treasurer; E. J. Williams, Controller and Secretary; R. G. Jones, Assistant Controller; and J. H. Schoemaker, Assistant Secretary and Assistant Treasurer.

## PENNSYLVANIA GLASS SAND APPOINTS GENERAL TRAFFIC MANAGER

The Pennsylvania Glass Sand Corporation has announced the appointment of Arthur C. Roy as General Traffic Manager.

Mr. Roy comes to the Pennsylvania Glass Sand Corporation from Eastern Gas and Fuel Associates where he has been employed for the past six years as Traffic Manager. He is a past president of the Traffic & Transportation Association of Pittsburgh, a Certificate Member of the American Society of Traffic and Transportation, Inc., and an active member of the Traffic Club of Pittsburgh, The National Industrial Traffic League, The National Freight Traffic Association, The Allegheny Regional Advisory Board, Association of Interstate Commerce Practitioners and other local and national traffic, transportation and civic associations.

● Above illustration shows a special electric oven for the annealing of light ware as required for the electronic field.

Our knowledge of glass factory problems is your assurance of first quality glass melting and manufacturing equipment, as well as top service and performance.

We shall be pleased to consult with you concerning your manufacturing problems.

**HENRY F. TEICHMANN, INC.**

INVESTMENT BUILDING PITTSBURGH 22, PA.
*Telephone:* COurt 1-6210 *Cable: HEFTINC*

## LINK BELT SALES CHANGES

Link-Belt Company has announced the appointment of James H. Oakes, former Sales Manager for enclosed drives, as Sales Manager for the Philadelphia plant, and Byron K. Hartman, former assistant sales manager at Philadelphia, as Sales Manager for the new Colmar plant, which will begin manufacturing operations later this year.

Mr. Oakes joined Link-Belt Dodge plant in Indianapolis in 1929. In Indianapolis and Philadelphia, he took part in the development and engineering application of the Link-Belt P.I.V. variable speed drive. He has served as application engineer, divisional sales manager and sales manager, enclosed drives.

Mr. Hartman joined the firm at Philadelphia in 1937. He subsequently handled sanitary engineering sales in Chicago and later returned to Philadelphia to head up industrial waste and liquid treatment work. He was engineer in charge of vibrating screen sales before becoming assistant sales manager.

## FOOTE ANNOUNCES THREE MILLION DOLLAR LITHIUM EXPANSION

H. C. Meyer, Board Chairman of Foote Mineral Company, has announced plans for a three-way expansion of the company's lithium production.

Involving approximately three million dollars, the program includes construction of the world's largest and most modern lithium chemical processing plant at Sunbright, Virginia; tripling the output of lithium ore at its property near Kings Mountain, North Carolina; construction of facilities for quarrying and processing limestone at Sunbright, Virginia.


AMCO

Design, Erection and Operation of Manufacturing Plants and Furnaces for All Types of GLASS WARE

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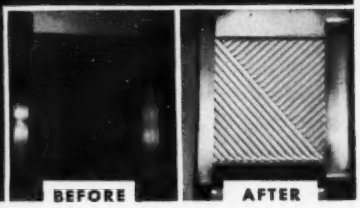


***Complicated molds*** are easily cleaned and left *ready for use* with Pangborn Hydro-Finish! Hand cleaning and polishing is virtually eliminated! And you save additional time and labor because a Hydro-Finish machine, operated by one man, removes discoloration and scale in *minutes* instead of hours!

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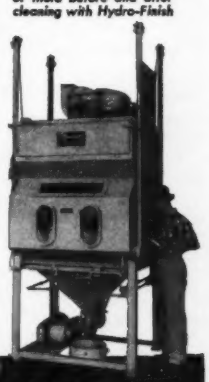
*Actual untouched photos of mold before and after cleaning with Hydro-Finish*



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## NPA APPOINTS DIRECTOR OF CHEMICAL DIVISION

The appointment of Dr. George E. Holbrook as Director of the Chemical Division of the National Production Authority, has been announced.

Dr. Holbrook, who is assistant director of the development department of E. I. du Pont de Nemours & Co., Inc., has been serving as Assistant Director of NPA's Chemical Division since March 31, 1952.

## FERRO OPENS GLASS FIBER PLANT IN TENNESSEE

The Ferro Corporation of Cleveland has announced the opening of a new million-dollar fiber glass plant in Nashville, Tennessee, which will specialize in the production of fiber glass for the plastic reinforcement field.

According to C. D. Clawson, President of Ferro, the new plant will be headed by W. G. Cole, Jr., Manager of the firm's newly created Fiber Glass Division. Mr. Cole was formerly Manager of Ferro's New Products Division. Mr. Cole said that the new plant will produce a highly uniform mat 48 inches in width and rolled into a continuous length.

In order to build up a specialist position, Ferro will concentrate on development and production techniques for other manufacturers interested in fiber glass reinforcement of plastic parts. A new industrial service termed "Fibercating" will be offered through the new Division of the Corporation. For manufacturers who want to investigate fiber glass-reinforced plastics in relation to their other products, the new service will include designing the product, tooling for it, formulating a suitable composition and placing it in trial production on production-sized equipment.

## CAMBRIDGE WIRE EXPANDS FACILITIES

The Cambridge Wire Cloth Company is increasing facilities for the production of medium-heavy and heavy grades of industrial wire cloth.

In comment on the expansion, H. F. Pink, Manager of the Wire Cloth Division, said, "Steadily increasing demand for our heavier grades of wire cloth have made it necessary for us to undertake this expansion program in order to continue to maintain a regular schedule of shipments of customer orders. Not only will this new equipment increase our capacity, it will also enable us to offer more prompt delivery on certain items."

## O. HOMMEL COMPANY TRANSFERS SALES REPRESENTATIVE

Ed Davis, sales representative of The O. Hommel Company, has been transferred to the West Coast as a sales representative in the Southern California territory.

Mr. Davis attended Ohio State University and was a Pilot in the Army Air Corps during the war. He has been associated as Plant Engineer with Brush Pottery Company and was Superintendent of American Bisque Company.

Mr. Davis is a native of California and because of his ceramic training and experience in working with problems on glass and pottery colors, as well as glaze stains and body formulations, he is well qualified to service the needs of ceramic manufacturers in his territory.

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### KIRK R. BRYCE, FORMER OFFICER OF BRYCE BROTHERS, DIES

Former President and Chairman of the Board of Directors of Bryce Brothers Company Kirk R. Bryce passed away at his home in Mt. Pleasant on June 12. Mr. Bryce is survived by his wife, son and three daughters.

### KIRK & BLUM HONORS OLD EMPLOYEES

The Kirk & Blum Manufacturing Company recently honored 40 employees who have been associated with the firm from 25 to 44 years. Each person received a suitably engraved gold watch.

The longest service record in the group is held by a foreman, E. W. Thiery, who joined the firm on June 1, 1907, just three weeks after it was founded by the late Sylvester Kirk and Richard J. Blum. The fact that the company had just passed its 45th anniversary was also noted at the dinner.

The men honored at the dinner returned the compliment with a set of matched luggage, presented to the firm's President, Richard J. Blum, Jr.


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